MODEL V-1065/V-1060/V-665/V-660

OSCILLOSCOPE

OPERATION MANUAL

Hitachi Denshi, Ltd.

MP MASTER
MA23281

WARRANTY

This Hitachi Denshi, Ltd. product is warranted against defects in workmanship and materials. If any failure, resulting from a defect in either workmanship or material shall occur under normal use within THREE YEARS from the original date of purchase, such failure shall be corrected free of charge to the original purchaser by repair or, at Hitachi Denshi's sole option, replacement of the defective part or parts. No charge shall be made for labor or services performed during said THREE YEARS period providing the defective product is brought or sent prepaid to our Authorized Service Station. Hitachi Denshi, Ltd. will either repair or at its sole option, replace any part except for fuses, probes, lamps, batteries and other optional materials which are defective in either workmanship or material under normal and proper use.

This warranty does not cover equipment which has been tampered with in any way, or to damage caused by accident, negligence, alteration, or misapplication.

This product must be returned transportation prepaid, properly packed and insured. Hitachi Denshi, Ltd. bears transportation cost of the repaired product back to the purchaser. This warranty applies only to the original purchaser.

NO OTHER WARRANTIES ARE EXPRESSED OR IMPLIED. HITACHI DENSHI, LTD. IS NOT LIABLE FOR CONSEQUENTIAL DAMAGES.

NOTES FOR A SAFETY OPERATION

Before operating the oscilloscope, be sure to check the following items.

(1) Terms in this manual

WARNING: Indicates a possible injury to a body or danger to life if care is not taken as described.

CAUTION: Indicates possible damage to the oscilloscope or other equipment if care is not taken as described.

(2) Symbols

DANGER: Indicates the part which may cause an injury to a body or danger to life.

DANGER: Indicates the high voltage part in the oscilloscope.

CAUTION: Indicates to read the applicable items in this manual.

: Protective earth terminal

(3) Notes for operation

① Connection with the AC power source

The oscilloscope is provided with the protective earth terminal and the three-line power cord and plug to be connected to the AC power source. The lead of the protective earth terminal is connected to the metalic part of the oscilloscope.

Be sure to plug the power cord into an AC outlet provided with a protective earth terminal to avoid the risk of electric shock.

② Replacement of fuse

Use only specified fuses.

The instrument is protected by a 2 A fuse on the primary side of the power supply.

When this fuse blows, contact your nearest Hitachi Denshi representative. Do not try to use any fuse other than the specified ones.

Otherwise, further damage may occur and this could be dangerous.

(IMPORTANT: Use only the fuse of same size and rating as specified.)

	Shape (Diameter x length) mm	Type
2 A	5.2 x 20	EAK-2A

③ Operation in gas

Do not use the oscilloscope in combustible gas or vapor to avoid possible explosion.

④ POWER switch

Before plugging in the AC cord, be sure to check that the POWER switch is set to OFF for protection of the equipment.

⑤ Removal of the chassis

To avoid the risk of electric shock, do not remove the chassis by yourself. Contact your nearest Hitachi Denshi representative.

NOTE

- The oscilloscope operates normally with the 90 to 250 V line voltage. If the line voltage is out of the above range (especially low voltage), the normal operation may not be restored even after the correct line voltage is applied. Use the oscilloscope within the specified line voltage. If an abnormal operation occurs, check the line voltage, turn off the power for a short time, and then turn it back on.

WARNING:

Do not remove the chassis cover since a high voltage presents inside the equipment. When parts inside the equipment need to be adjusted or replaced, contact your nearest Hitachi Denshi representative.

- When the power is turned on, the built-in microprocessor automatically calibrates the time base and diagnoses the sweep circuit operation. After the calibration, the time base settings are initialized.
  The displays "CALIBRATION" and "COMPLETED" appear to show the normal calibration and sweep circuit operation. If other displays such as "CALIBRATION FAILED AT CYCLE CKT" appear and the display remains even when the power is turned off and on, contact your nearest Hitachi Denshi representative.

NOTES:

- It will take twenty seconds approx. until the automatic calibration and diagnosis are completed after the power is turned on.
- When the power switch is turned on after storage at a low temperature, it takes some time before the circuit operation becomes stable.

If a failure display appears while the power is on, keep the power-on state for several minutes. Turn off the power, then turn it back on, and check that the "COMPLETED" display appears.

- The built-in microprocessor may misoperate when turning the power switch on/off rapidly. Avoid rapid toggling of the power switch and allow three seconds or more for toggling.

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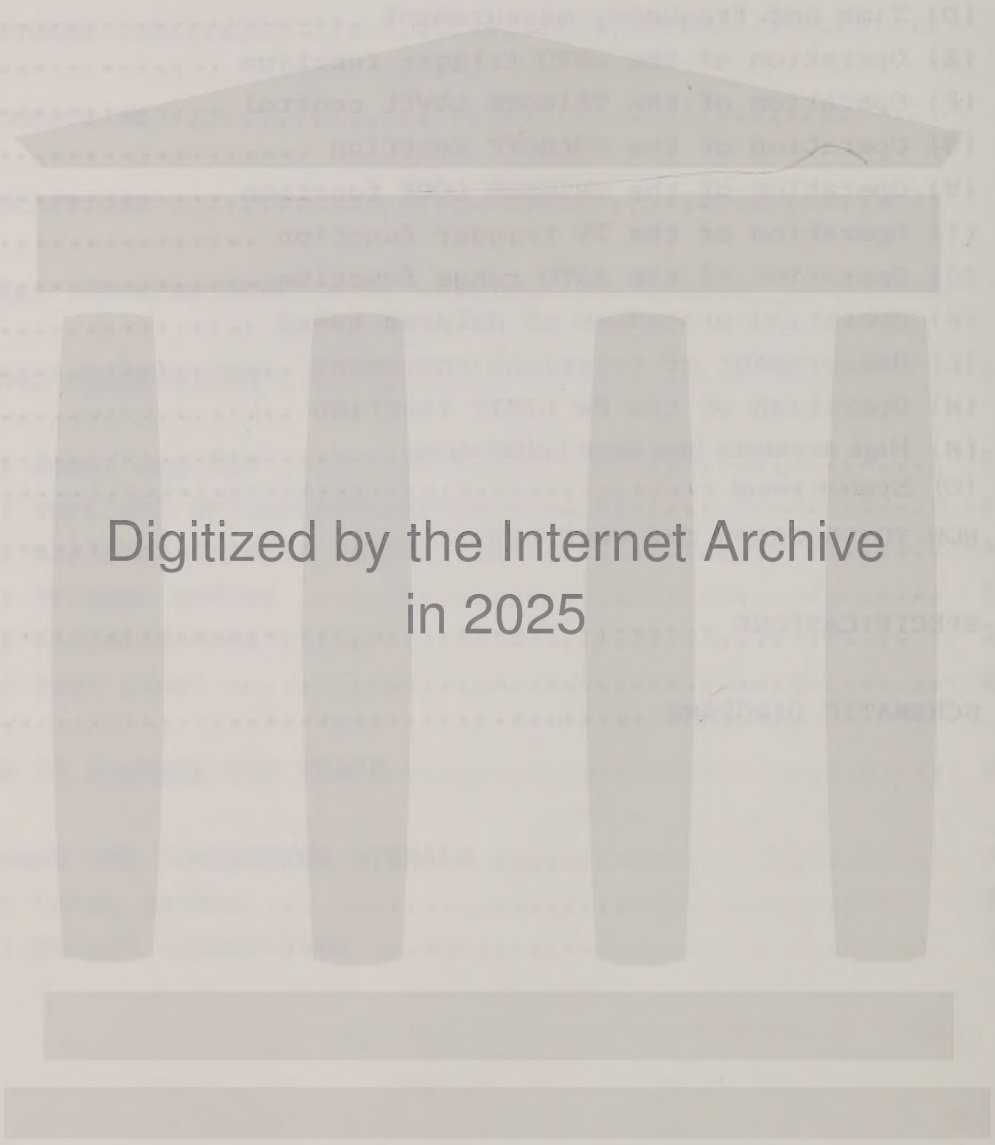

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1. FEATURES

The Hitachi portable read-out oscilloscope provides measurement reliability and ease of operation by employing a microprocessor.
The major features are:

(1) Measurement information display

The measurement information including the sweep speed, the delay time, the UNCAL display, and the voltage sensitivity of the vertical axis (V-1065 and V-665 only) is alphanumerically displayed on the CRT.

Since troublesome setting operation procedures are eliminated, an operator can concentrate on the displayed data for measurement.

(2) Measurement value display (V-1065, V-665 only)

The distance between the two cursors displayed can read out the following;

- Δ V : Voltage between the reference cursor and the delta cursor
- Δ T : Time between the reference cursor and the delta cursor
- 1/Δ T: Reciprocal of the time

The displayed data eliminates troublesome and time consuming calculation procedures. Moreover, miscalculation of the scales is completely avoided.

(3) Automatic time base range setting

At a press of the AUTO button, an optimum time base range is automatically set. (A signal period from 1.6 to 4 cycles approx. is displayed.)
The time base range is automatically changed to a corresponding change in input signal period.

(4) Trigger lock

Since complicated pulse train waveforms are hard to trigger on, performing the trigger lock function enables sweep independent triggering. The "sweep time plus holdoff time" is fixed and a stable trigger is obtained at any time range.

(5) Bandwidth

V-1065, V-1060:	DC-100 MHz from 5 V/div to 5 mV/div
	DC-20 MHz at 2 mV/div
V-665, V-600 :	DC-60 MHz from 5 V/div to 5 mV/div
	DC-10 MHz at 2 mV/div

(6) High sensitivity

High sensitivity of 2 mV/div is provided.

(7) Internal graticule

Internal graticule lines eliminate parallax-viewing error between the trace and the graticule lines.

(8) Delayed sweep

With delayed sweep, a portion of the signal can be magnified for more accurate measurement and time comparison. The delay time is digitally displayed and the window of delayed sweep (B) is indicated on the main sweep (A) with cursors.

(9) Auto trigger level

Auto measuring of trigger level is employed, so that trigger level range is matched to the trigger signal for maximum trigger sensitivity and stability.

(10) TV triggering

Exclusive TV sync separator circuit technology provides stable TV signal measurements on fields, frames and lines.

2. ACCESSORIES

The oscilloscope is shipped with the following standard accessories:

2 Probes (AT-10AP1.5)
1 AC power cord (3-conductor)
1 Operation manual
1 Fuse (2A) (inside the fuse holder of the oscilloscope as a spare)

3. PRECAUTIONS

The following precautions should be observed to lengthen the service life of this instrument.

Installation site

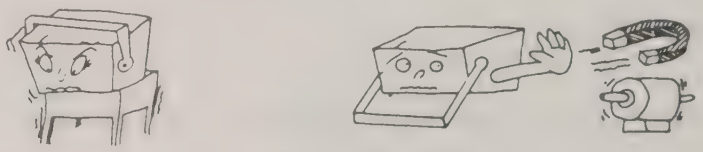
* Avoid installing this instrument in an extremely hot or cold place.
  - o Avoid placing this instrument in a place exposed directly to sunlight for a long period of time, in a closed car in midsummer, or near a heating device.
  - o The maximum operating ambient temperature is 50°C.

* Do not use instrument that has been left outdoors or stored at sub zero temperatures. The operating ambient temperature is 0°C or more.

* Avoid excessively damp, wet, or dusty conditions. The operating ambient humidity is 35 to 85%.

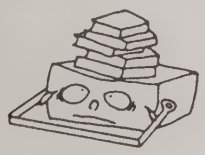
* Do not place the instrument in a place subject to strong vibration. Since the oscilloscope is a precision instrument, excessive vibrations may cause damage.

* Do not place the instrument near a magnet or strong magnetic field. An oscilloscope uses an electron beam and will be effected by a strong external magnetic field.

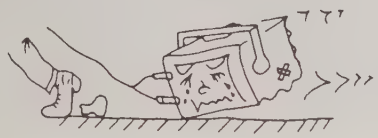


Handling

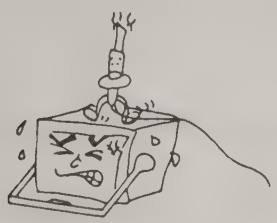
* Do not put a heavy object on the oscilloscope.
* Do not block the ventilation holes.
* Do not apply a heavy shock to the oscilloscope.

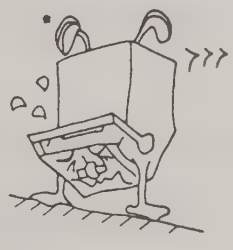


* Do not insert a wire, pin, etc. through the ventillation holes.
* Do not drag or carry the set, leaving the probe attached to it.

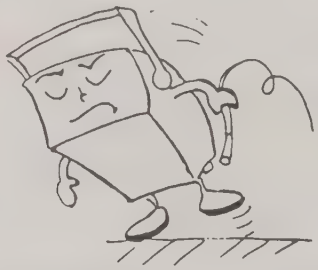


* Do not leave a hot soldering iron on and around the cabinet or the screen.
* Do not set the instrument on its face, otherwise knobs may be broken.





* Do not use the instrument upright, when BNC cables are connected to EXT BLANKING, and TRIG SIGNAL OUTPUT terminals on the rear panel (V-1065 and V-665 only) unless using a tee or elbow connector. The cables may be damaged.



Faulty operation

* Recheck the operating procedure. If problem persists, contact a local service facility.

Care and repair

* **Removal of stain from the case**
  - o When the surface of the case is stained, remove the stain by first wiping it lightly with a cloth moistened with a neutral detergent and then wipe the surface with a dry cloth.

* **Never use strongly volatile agents such as benzine and thinner.**
  - o When the panel surface is stained, remove the stain with a clean, soft cloth. When heavy stains are present, first remove them by wiping the surface lightly with a cloth moistened with a diluted neutral detergent and then wipe thoroughly with a dry cloth.

Maintenance

(1) Use and store the oscilloscope carefully, so as not to damage the built-in precise components.
(2) Clean the CRT screen and the scale plate from time to time with a clean soft cloth.
(3) Side panel can be removed by unscrewing the screws.
(4) The recommended ambience is 20°C, 65%.

Cautions to be observed before measurement

* **Line voltage check** ⚠
The operating voltage range of this oscilloscope is 90 to 250 V AC. Check the line voltage without fail before turning on the power switch.
The oscilloscope is provided with the power cable normal to the country of import.

* **Do not use excessive brightness**
This will reduce eye strain and reduce the risk of burning the phosphorescent surface of the CRT.

* Do not exceed the rated input voltage of the connector or the probe. Never apply a voltage higher than specified as follows:

INPUT direct	400 V (DC + peak AC at 1 kHz or less)
With probe	500 V (DC + peak AC at 1 kHz or less)
EXT BLANKING	30 V (DC + peak)

CAUTION: A voltage exceeding the above may damage the equipment.

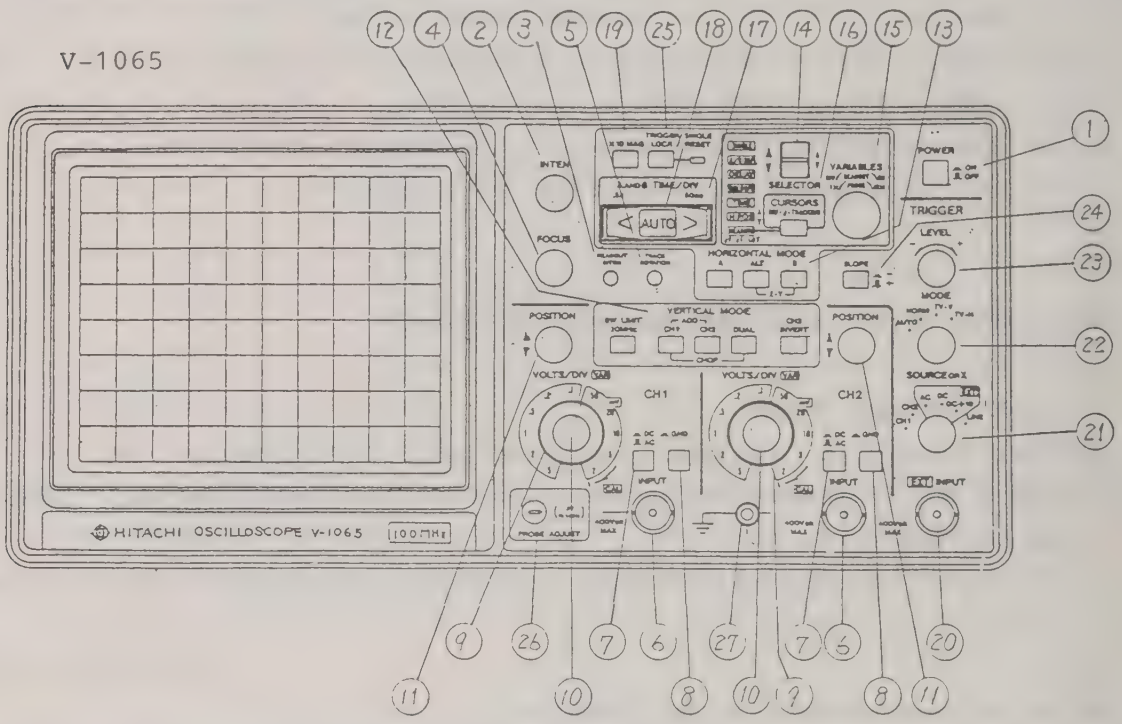
Calibration interval

To maintain instrument accuracy, calibration is recommended at least every 1000 operating hours, or every six months.

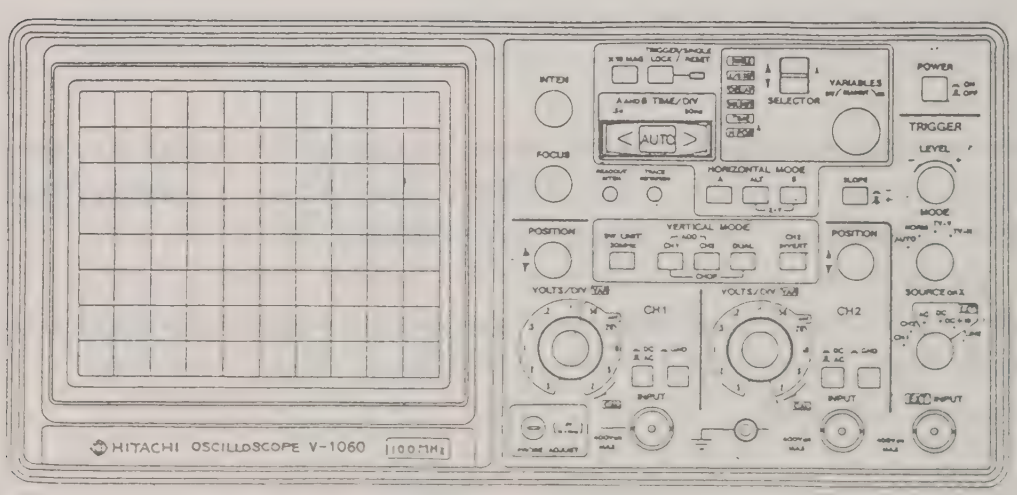
4. PANEL ILLUSTRATIONS

(1) Front panel

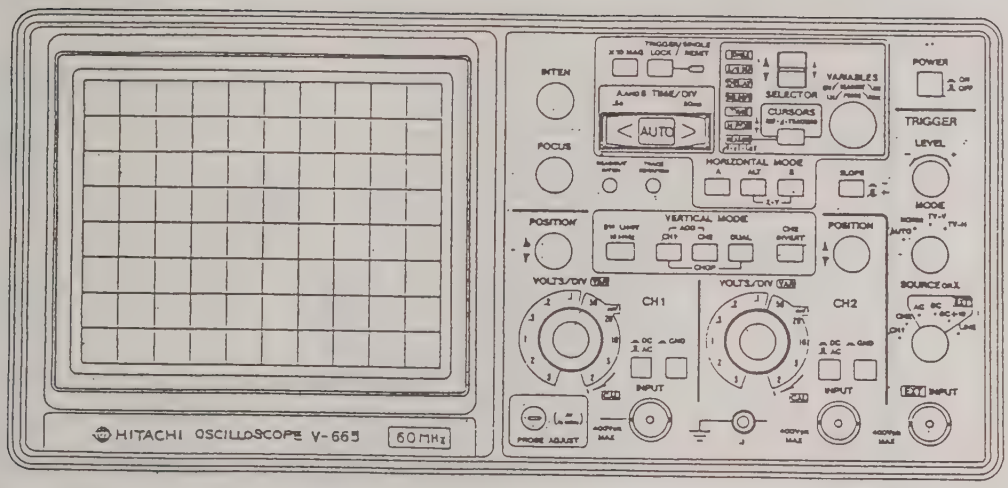
V-1065



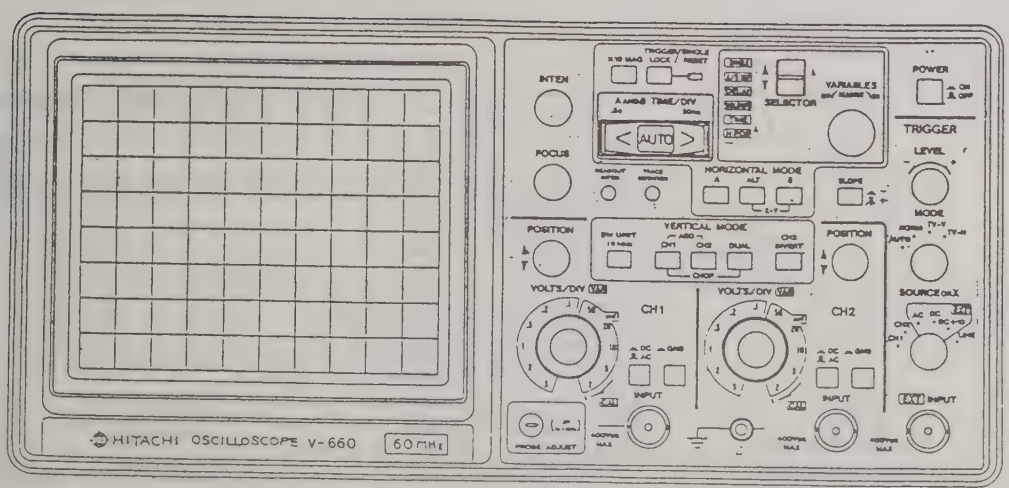
V-1060



V-665

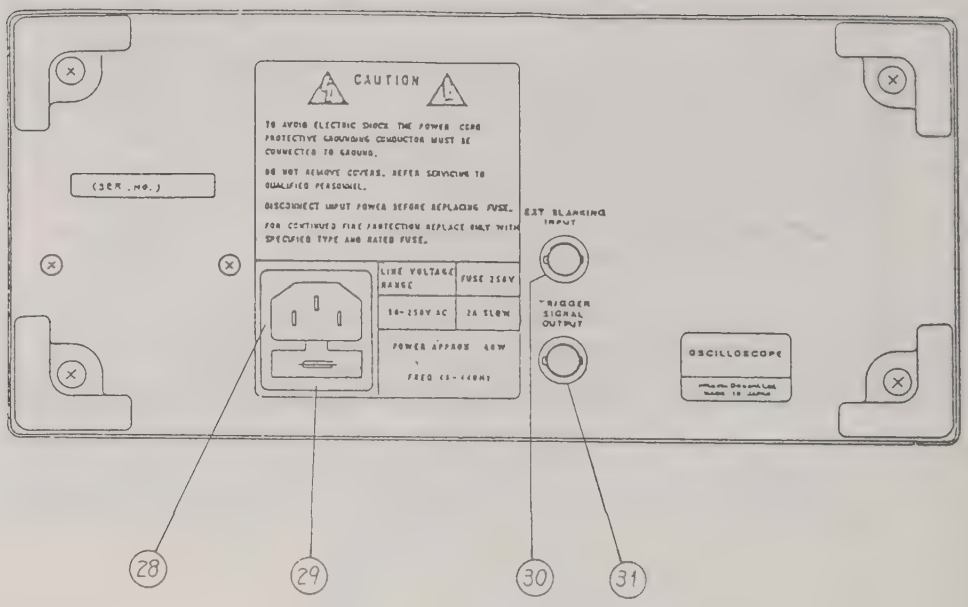

INTEN
FOCUS
TRIGGER/SINGLE LOCK / RESET
A and B TIME/DIV
AUTO
SELECTOR
CURSORS
VARIABLES
POWER
TRIGGER
LEVEL
MODE
SLOPE
HORIZONTAL MODE
VERTICAL MODE
POSITION
VOLTS/DIV
CH1
CH2
INPUT
SOURCE
EXT INPUT
PROBE ADJUST
HITACHI OSCILLOSCOPE V-665
60MHz

V-660

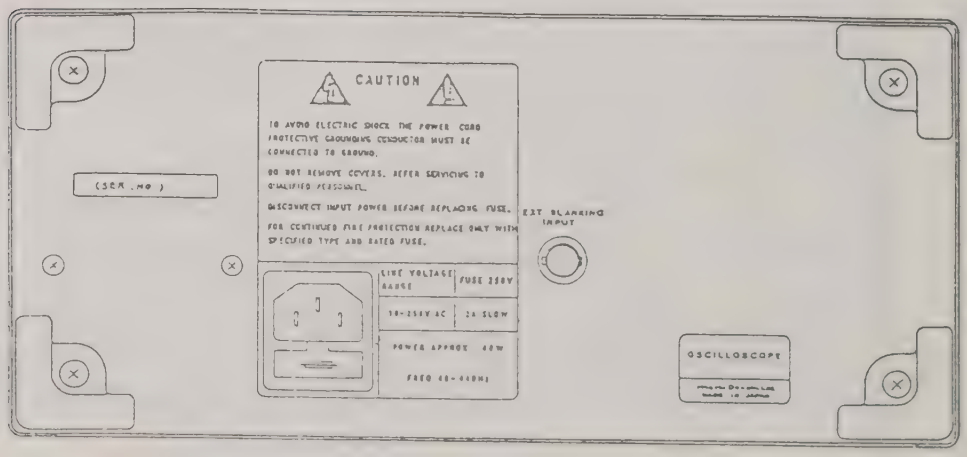

INTEN
FOCUS
TRIGGER/SINGLE LOCK / RESET
A and B TIME/DIV
AUTO
SELECTOR
VARIABLES
POWER
TRIGGER
LEVEL
MODE
SLOPE
HORIZONTAL MODE
VERTICAL MODE
POSITION
VOLTS/DIV
CH1
CH2
INPUT
SOURCE
EXT INPUT
PROBE ADJUST
HITACHI OSCILLOSCOPE V-660
60MHz

(2) Rear panel

V-1065, V-665



V-1060, V-660


CAUTION
TO AVOID ELECTRIC SHOCK THE POWER CORD PROTECTIVE GROUNDING CONDUCTOR MUST BE CONNECTED TO GROUND.
DO NOT REMOVE COVERS. REFER SERVICING TO QUALIFIED PERSONNEL.
DISCONNECT INPUT POWER BEFORE REPLACING FUSE.
FOR CONTINUED FIRE PROTECTION REPLACE ONLY WITH SPECIFIED TYPE AND RATED FUSE.
(SER. NO.)
LINE VOLTAGE RANGE
FUSE 250V
90-250V AC
2A SLOW
POWER APPROX 40W
EXT BLANKING INPUT
OSCILLOSCOPE

5. PANEL DESCRIPTION

(A) Power and CRT

(1) POWER

Power is ON in the pressed mode (▬), and OFF in the released mode (▮).

(2) INTEN

Adjusts the brightness of a waveform.

(3) READOUT INTEN (screwdriver adjustment)

Adjusts the brightness of characters displayed on the CRT.

(4) FOCUS

After obtaining an appropriate brightness by operating the INTEN control, adjust the FOCUS control until the trace has best definition. Although the FOCUS is corrected automatically when the INTEN control is rotated, focus is subjective. In this case, adjustment is provided.

(5) TRACE ROTATION (screwdriver adjustment)

Corrects a slight tilting of trace caused by external magnetic fields. Align the trace with the horizontal graticule line with this control.

(B) Vertical deflection system

⑥ INPUT

BNC connector for CH1 and CH2 input.

⑦ AC-DC

Selects the method of coupling the input signal to the vertical deflection system.

AC: Input signal is capacitively coupled to the vertical attenuator. The DC component of the input signal is blocked. Minimum frequency response is 10 Hz with 1X probe and 1 Hz with 10X probe.

DC: All frequency components of the input signal are coupled to the vertical attenuator.

⑧ GND

This is an input coupling select switch.
The input of the vertical amplifier is grounded in the pressed mode (⏚).

⑨ VOLTS/DIV

This is a step attenuator which selects the sensitivity.
Set to appropriate range according to incoming signal level.

⑩ VAR controls

* Provide a continuous variable deflection factor.
  Attenuation of up to 2.5X is obtained by turning in a counterclockwise direction.

* These controls are useful when comparing two waveforms or when measuring the rise time of a pulse.
* Normally turned fully clockwise to the CAL position.

⑪ POSITION

Sets the vertical position.
Clockwise rotation moves the associated trace upward while counterclockwise rotation moves it downward.
NOTE: The CH2 signal is inverted (180° out of phase) in the CH2 INVERT mode.

⑫ VERTICAL MODE

Selects the operating mode of the vertical amplifier.

CH1: Displays the Channel 1 signal.
CH2: Displays the Channel 2 signal.
DUAL: Displays the channel 1 and channel 2 signals. (Dual-trace mode)
The display mode is automatically selected by the TIME/DIV switch setting. When the TIME/DIV switch is set to 5 ms/DIV or slower, the CHOP mode is obtained. When the switch is set to faster range, the ALTERNATE mode is obtained.
In case of the ALTERNATE mode, Channel 1 and 2 signals are alternately displayed.
CHOP: When the CH1 and DUAL switches are pressed simultaneously, the CHOP mode is obtained regardless of the sweep rate. Channel 1 and 2 signals are switched at about 250 kHz rate regardless of the sweep and they are simultaneously displayed on the CRT.
This is used for observation of waveforms in the CHOP mode at a fast sweep range.

NOTE: To prevent triggering from chopping transients, apply a triggering signal to the EXT INPUT connector and set the TRIGGER SOURCE to EXT, or set the internal trigger level very carefully.

ADD: Displays the algebraic sum of Channels 1 and 2 when both CH1 and CH2 keys are pressed.

CH2 INVERT:

Allows the polarity of the CH2 signal to be inverted. It is recommended to use this function when comparing different polarity waveforms or when observing differential signals where it is in appropriate to measure with respect to ground and you wish to establish CH2 as the reference.

BW LIMIT:

When this switch is pressed, the bandwidth is reduced to approximately 20 MHz (10 MHz for the V-665 and the V-660) and the observation is made by eliminating interference from undesired high-frequency signals.

(C) Horizontal deflection system

⑬ HORIZONTAL MODE switch

Selects the operation mode of the horizontal deflection.

A: Main sweep (A) appears on the CRT.
This setting is used in normal cases.

ALT: Both main sweep (A) and delayed sweep (B) are displayed. (Cursor measurements are inoperable in this mode.)

B: Delayed sweep appears on the CRT. The sweep time is controlled by the B time base.

X-Y: When the ALT and B switches are pressed simultaneously, an X-Y operation is available.

⑭ SELECTOR

Selects the variable functions of the horizontal amplifier and cursor. Move the SELECTOR lever upward and downward to illuminate the desired function lamp. Then adjust the VARIABLES control ⑮.

SINGLE: Displays the main sweep (A) once.

A/B SEP: Adjusts the vertical position of the delayed sweep (B) in the ALT sweep mode.

DELAY: Used to set the delay time of the delayed sweep (B) starting point with respect to the main sweep (A) starting point. The delay time is displayed on the upper left side of the CRT and the B sweep window is indicated by the cursors.

HOLDOFF: Increases the holdoff time to trigger and aids triggering on complex displays such as high-frequency signal, irregular signal and digital words.

Rotate the HOLDOFF control to obtain stable triggering. The holdoff value is set to the minimum when the power is turned on or when the A TIME/DIV switch ⑰ is operated. This control is used in conjunction with trigger lock to obtain sweep independent stable triggering on complex wave trains.

TIME: (variable) Adjusts the sweep speed of the main sweep (A) continuously. When the control is turned fully clockwise (CAL position), the sweep speed is calibrated to the specified value. Normally, set to fully clockwise position (A = on the CRT). The variable time is set to the CAL state when the power is turned on or when the A TIME/DIV switch is operated.

H POS: Used to adjust the horizontal direction. Display is moved to right side when the control is rotated clockwise and to left side with counterclockwise rotation.

MEASURE: In this mode, ΔV, ΔT and 1/ΔT can be selected and displayed in turn on the CRT by moving down the SELECTOR lever. Measurements by cursors are available on the V-1065 and V-665 only.

ΔV: Two horizontal cursors appear. The voltage between the two cursors is displayed with ΔV on the upper side of the CRT. It corresponds to the setting of VOLTS/DIV.

ΔT: Two vertical cursors appear. The time between two cursors is displayed with ΔT on the upper side of the CRT. It corresponds to the setting of TIME/DIV.

1/ΔT: Two vertical cursors appear. The reciprocal of the time (frequency) between two cursors is displayed with 1/ΔT on the upper side of the CRT. It corresponds to the setting of TIME/DIV.

⑮ VARIABLES

Sets the function selected by the SELECTOR ⑭ . Clockwise rotation moves the trace up(↑) or right(→). Counterclockwise rotation moves the trace down(↓) or left(←).
A combination use with the SELECTOR can blank characters on the CRT and calculate values of the 1X and 10X modes of a probe. (For details, refer to section 8, sub section A ⑤, NOTES ⓐ and ⓑ.)

⑯ CURSORS REF•Δ•TRACKING (V-1065, V-665 only)

REF: Moves the reference cursor on the CRT. (▽ or ▷ is displayed on one cursor.)

Δ: Moves the measuring cursor on the CRT. (▽ or ▷ is displayed on one cursor.)

TRACKING: Simultaneously moves the reference cursor and the measuring cursor with the interval between the two cursors unchanged. (▽ or ▷ is displayed on two cursors.)

⑰ A AND B TIME/DIV

Sets the sweep time of the main sweep (A) and the delayed sweep (B). The sweep is set by the HORIZONTAL MODE switch ⑬ and the sweep time is displayed on the CRT.

A sweep time: 0.5 s/DIV - 50 ns/DIV
B sweep time: 50 ms/DIV - 50 ns/DIV

The B sweep time is always set faster than the A sweep time except in the 50 ns/DIV.

NOTE:
When the TIME/DIV switch is operated, the characters on the CRT may become blank momentarily.

⑱ AUTO

When the center of the TIME/DIV switch is pressed, the AUTO lamp lights. The incoming signal is detected, the time range changes automatically, and approx. 1.6 to 4 waveforms are displayed on the CRT. (For signals of 100 Hz or in the absence of a trigger, the time range is set to 5 ms/DIV. For signals of approx. 8 MHz or more, the time range is set to 50 ns/DIV.) The time range automatically changes according to the incoming signal. (For details, refer to section 8, sub section J.)

⑲ x10 MAG

Used to magnify A and B sweeps to 10 times. In this case, the sweep time is 1/10 times the value indicated by TIME/DIV. Bring the portion of the waveform to be magnified to the center of the CRT by selecting [H POS] and rotating VARIABLES ⑮ . Then press the x10 MAG switch and the waveform placed at the center is magnified.
By controlling the x10 MAG, the sweep speed readout is automatically converted.

(D) Trigger system

⑳ EXT INPUT

BNC connector for an external trigger signal, an external sweep signal, or an external X input.

(21) TRIGGER SOURCE OR X

Selects the trigger signal source or the X signal for an X-Y operation.

CH1: The signal fed to CH1 is used.

CH2: The signal fed to CH2 is used.

EXT AC: The signal fed to EXT INPUT is used as a signal after the DC component is removed.

EXT DC: The signal fed to EXT INPUT is used as is. This signal is used when affecting synchronization to a very low frequency signal.

EXT DC÷10: The signal fed to EXT INPUT is attenuated to 10:1 and used as a signal. This signal is used when affecting synchronization to a very low frequency.

LINE: Used to observe the signal synchronized to a line frequency.

(22) TRIGGER MODE

AUTO: The instrument will automatically display a trace without an input signal being applied or out of trigger. This setting is convenient in most cases. Normal trigger will be established by setting trigger level when a signal is applied to the input. The trigger level corresponds to the amplitude of the incoming signal and synchronization is easily executed.

NORM: No trace will appear, unless a signal or external trigger is present. Use this MODE when effecting synchronization to a very low frequency signal (30 Hz or less) or for arming single sweep.

TV-V: Used when observing the entire vertical video signal.

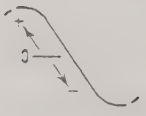
TV-H: Used when observing the entire horizontal video signal.

(23) TRIGGER LEVEL

By controlling the trigger level, the sweep start point of the waveform is set.

Explanation of trigger LEVEL

During ⊕ SLOPE



During ⊖ SLOPE

(24) SLOPE

Select the triggering polarity of (+) or (-).

During
⊕ SLOPE

Triggered on the continuous line

During
⊖ SLOPE

㉕ TRIGGER LOCK/SINGLE RESET

When the SINGLE RESET switch is not operated:
When the TRIGGER LOCK switch is pressed and the lamp is lit, the synchronized state before the lamp is lit is held. If the synchronization is executed before the lamp is lit, and the TRIGGER LOCK switch is pressed, the stable synchronization is ensured when the sweep time and the variable time are changed.

When the SINGLE RESET switch is pressed and the lamp is lit:
The single sweep is armed.

NOTE:
When the TRIGGER MODE switch is set to AUTO, the sweep is performed once by pressing this switch, asynchronously with the incoming signal. Usually the single sweep function is used in conjunction with NORM triggering to detect and trigger on anomalies, aberrations, or one time events.

(E) Miscellaneous

㉖ PROBE ADJUST

A 0.5 V-1 kHz squarewave signal is available. This terminal is used for probe calibration.

㉗ GND terminal (⏚)

Earth terminal grounding.

(F) Rear panel

(28) AC input connector

Provides the connection point for the AC power source to the instrument.

(29) FUSE

The fuse is inside the fuse holder.
CAUTION: When the fuse is blown out, contact your nearest Hitahci Denshi representative.

(30) EXT BLANKING INPUT

This is a terminal for applying a blanking signal from an external source. The trace displayed on the screen may be intensity-modulated where pulse signal or time-scale marks are required.

(31) TRIGGER SIGNAL OUTPUT (V-1065, V-665)

The signal selected by the TRIGGER SOURCE OR X control (21) is available.

6. HOW TO PRODUCE THE TRACE

Before turning ON the POWER switch, insure the AC supply voltage is within the range of 90 to 250 V AC supply.
Connect the power cord on the rear panel to an AC outlet and set the controls as follows.

GND	▬	(Pressed mode)
POSITION	Midrange	

Turn the POWER switch on, set the HORIZONTAL MODE to A, set the TRIGGER MODE to AUTO, and rotate the INTEN control clockwise, and a trace appears.
Adjust the FOCUS control to obtain the sharpest trace.
When this instrument is not in use, with power supplied, rotate the INTEN control counterclockwise to decrease the intensity. This protects the CRT from image burn and increases its life expectancy.

NOTES:

(1) For normal operation, the following function must be set in the 'CAL' position.

VOLTS/DIV VAR: Push in and rotate in the fully clockwise direction. In this case, the VOLTS/DIV is calibrated to the indicated value.

TIME/DIV VAR: Set the time by the SELECTOR (14), and turn the TIME control clockwise until A = is displayed on the CRT. The variable time is initialized when the power is turned on or when the time range of the A sweep is changed. At this time, the A TIME/DIV is calibrated to the indicated value.

(2) Align the GND trace with the horizontal graticule line at the center of the screen by operating CH1 POSITION control. In some cases, the trace may be slightly oblique to the scale by the effect of earth magnetism.
In this case, align the trace with the horizontal graticule line at the center of the screen by properly adjusting the TRACE ROTATION control (screwdriver adjustment) on the front panel.

7. METHOD FOR CONNECTING SIGNALS

The first step of measurement is to connect the signal to the oscilloscope properly. Do it with utmost care.

WARNING: When connecting the probe or the signal input cable to the circuit to be measured, be sure to connect the ground side of the probe or the signal input connector to the ground side of the signal source. If not, potential difference between the oscilloscope and other equipment or earth ground may result in shock hazard and damage the oscilloscope, the probe, and other equipment.

(A) Using probes

Use the supplied probe when measuring a high frequency signal.

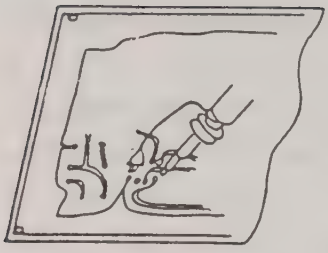
Supplied probe: AT-10AP1.5

When the 10X/1X switch on the probe is set to 10X, the input signal is attenuated by this probe to 1/10.

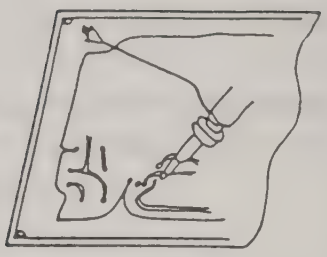
When the input signal level is so low as not to be measured at the 10X position setting, the switch must be set to 1X. In this case, the input impedance is different and the measureable frequency bandwidth becomes extremely low. (For further details, refer to the operation manual of the supplied probe.)

<NOTES>

- Do not apply a signal to the input in excess of 500 V (DC + peak AC at 1 kHz or less).
- Connect the probe ground lead as close as possible to the point being measured especially when measuring a fast rise time or a high frequency signal.
  Long probe ground leads may cause waveform distortions, such as ringing and overshoot.



(a) Proper



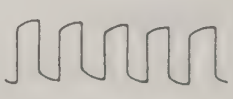
(b) Improper

Connection of ground lead

- To avoid effect of the ground lead in high frequency measurement, it is recommended to use the standard ground lead attachment with the AT-10AP1.5 probe.
- To avoid measurement error, probe compensation must be done especially when probes are changed on the instrument. Connect the probe tip to the PROBE ADJUST 0.5 V output terminal and the probe tip to the GND terminal. A 1kHz square wave should be displayed with flat tops. Any distortion in the presentation is caused by incorrect probe compensation. If overshoot or undershoot is present, turn the screwdriver adjustment in the probe for a flat-top presentation.

(a) Optimum

(b) Capacity too small



(c) Capacity too large

(B) Direct connections

If you are connecting signals without using the supplied probe, pay attention to the following points in order to minimize measurement error.

- o When using unshielded leads there should be no trouble provided they are high level signals from a low impedance source. However, in most cases, measurement errors may be caused by stray coupling with other circuits or power line interference.
  This can cause errors even at low frequencies.
  In general, avoid measuring with non-shielded wire. When using a shielded wire, it is desirable to use a coaxial cable with a BNC type connector. If a BNC type connector is not available, connect one end of the shield to the ground terminal of the oscilloscope and the other end to the ground of the circuit to be measured.
- o The following precautions must be observed when performing a wide bandwidth measurement. It is necessary to terminate the cable with a characteristic impedance, when measuring a fast rise waveform or a high frequency wave.
  The absence of a termination resistor will necessarily lead to a measurement error derived from ringing phenomenon in long cable. Some measuring circuits require a termination resistor equal to the characteristic impedance of the cable also be applied at the measurement point. (A BNC type termination resistor is recommended for this purpose).
- o In order to perform measurements with the circuit in a proper operating state, it is sometimes necessary to terminate the cable with an impedance which corresponds to the circuit being measured.

- The stray capacity of the shield wire must be taken into account when performing measurements with a long shield. Since the shield wire normally in use has a capacity of about 100 pF per meter, its effect on the circuit to be measured cannot be ignored.
  Use a x10 probe to minimize the effect on the circuit.
- When the length of the shield wire used or when the length of the non-terminated cable reaches 1/4 the wave length or its multiples within the band of the instrument (1/4 the wave length is about 0.5 meter when using a coaxial cable at 100 MHz), oscillation may be caused in the 2 and 5 mV/DIV range.
  This is caused by the resonance between the externally connected high-Q inductance and the input capacity. Reduce the Q by connecting the cable or shield wire to the input connector by the resistors connected in series, or by performing measurements at another VOLTS/DIV range.

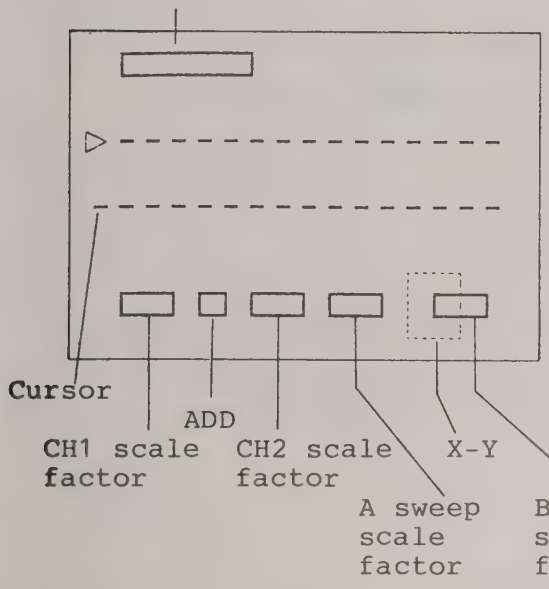
8. MEASURING PROCEDURES

(A) Readout function

Display allocation on the CRT

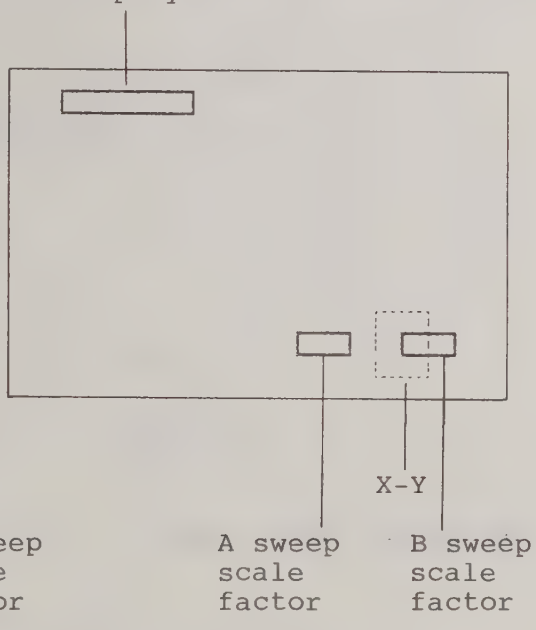
V-1065, V-665

Delay time, holdoff, cursor measurement displays

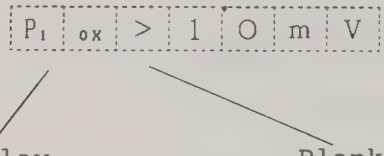


V-1060, V-660

Delay time and holdoff displays



① CH1 and CH2 scale factor displays (V-1065 and V-665)



Probe display

P_{10X} : 10X probe

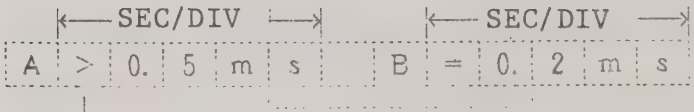
Blank: 1X probe or others

Blank : CAL

> : UNCAL

In the ADD mode, + is displayed between CH1 and CH2.

② A sweep, B sweep, and X-Y scale factor displays



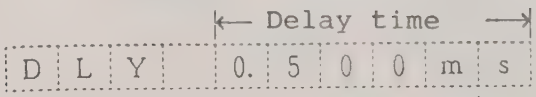
=: X1 CAL

*: X10 MAG

>: UNCAL

In the X-Y operation mode, X-Y is displayed and the TIME/DIV settings disappear.

③ Delay time display

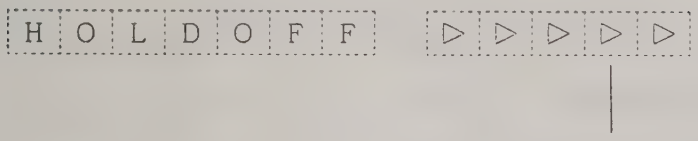


ms: A TIME/DIV (CAL)

div: A TIME/DIV (UNCAL)

Shows that the HORIZONTAL MODE switch is set to ALT or B.

④ HOLDOFF and TRIGGER LOCK displays

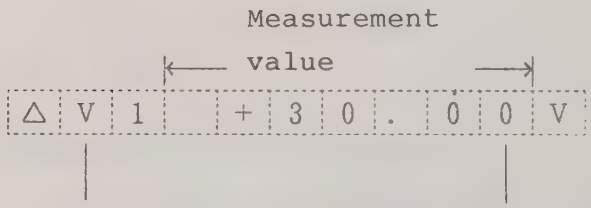


MIN: Minimum
▷▷▷: Holdoff time is graphed.
MAX: Maximum

Displayed in the trigger lock mode.

⑤ Cursor measurement value display (V-1065, V-665)

A measurement value between cursors is displayed.



ΔV1: CH1
ΔV2: CH2
ΔV^{1}_{2}: ADD
ΔTA: Time difference between two cursors for A TIME/DIV
1/ΔTA: Reciprocal number of ΔTA
ΔTB: Time difference between two cursors for B TIME/DIV
1/ΔTB: Reciprocal number of ΔTB

ΔV: +, -, mV, V, div
ΔT: +, -, ns, μs, ms, s, div
1/ΔT: mHz, Hz, kHz, MHz, ?

"div" is displayed in the following cases:

- o The measurement value in the channel selected by the VERTICAL MODE switch is not in the CAL state.
- o The VOLTS/DIV settings of CH1 and CH2 in the ADD mode are not equal.
- o The HORIZONTAL MODE switch is A and the TIME switch and the VARIABLES control function. (UNCAL state, CRT display:>)

NOTES

(a) Readout display appears when the power is turned on. If this display is not needed, select [H POS] by the SELECTOR, move the SELECTOR upward to light [TIME], and rotate the VARIABLES counterclockwise while holding the SELECTOR upward. The readout display then disappears.
To obtain the readout display again, select [H POS], move the SELECTOR upward, and rotate the VARIABLES clockwise, while holding the SELECTOR upward.

(b) The P_{10X} display is initialized when the power is turned on. To blank the display, select [H POS], hold the SELECTOR downward, and rotate the VARIABLES counterclockwise.
To obtain the display again, select [H POS], hold the SELECTOR downward, and rotate the VARIABLES clockwise.
The probe display can be switched to 1X or 10X only for the channel selected by the VERTICAL MODE switch.

(B) General measurement

① Observing a single waveform

Use Channel 1 or 2 when not observing the phase difference between two waveforms or when engaging in an operation other than X-Y operation.
Make the following settings when using Channel 1.

VERTICAL MODE switch:	CH1
TRIGGER MODE switch:	AUTO
TRIGGER SOURCE OR X switch:	CH1
AC-DC switch:	AC or DC

Under these settings all repetitive signals higher than 30 Hz applied to Channel 1 can be triggered on and observed by adjusting the A TRIGGER LEVEL control, with a TIME/DIV range of 2 ms/DIV or faster. Since the TRIGGER MODE is set to the AUTO position, a trace appears even when no signal is present or when GND switch is in the GND position. Therefore, DC voltage measurement can be made when the switch is placed to DC. When observing ultra-low frequency signals below 30 Hz, the following switch settings are required;

TRIGGER MODE:	NORM

Triggering can be effected by operating the LEVEL control under this setting.
When observing a signal of lower than 30 Hz, using other than CH1, use CH2, EXT DC or EXT DC ÷10 as a sync signal source.

② Observing two waveforms

Observation of two waveforms can be made easily by pressing the DUAL key of the VERTICAL MODE.

NOTES

i) When the A TIME/DIV setting is at 5 ms/DIV or slower in the DUAL mode, the mode is automatically set to the chop mode.
When the TIME/DIV setting is at 2 ms/DIV or higher, the mode is automatically set to the alternate mode.
If the chop mode is required when the TIME/DIV setting is at 2 ms/DIV or higher, press both the CH1 and DUAL keys.

ii) To measure phase difference, trigger on the leading signal.

③ Observing a waveform in the X-Y mode

Set the HORIZONTAL MODE to X-Y so that an X-Y oscilloscope is available. The X axis input is selected by the TRIGGER SOURCE OR X switch and the Y axis input is selected by the VERTICAL MODE switch to the CH1, CH2 and DUAL modes.

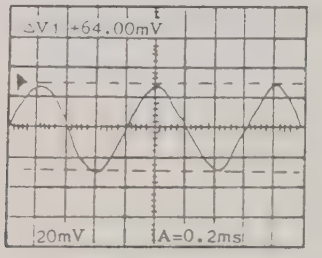
For the X-Y operation, set the x10 MAG key and the BW LIMIT key to off.

(C) Voltage measurement

① ΔV cursor measurement (V-1065 and V-665 only)

The measurable area by the ΔV cursors is 3 divisions above and/or below the center horizontal graticule line.
Set the VOLTS/DIV switch so that a waveform is within the area.
When a signal including a DC component is measured in the DC coupling mode, also set the POSITION control to set the GND trace within the measurable area.
When the [MEASURE] is selected by the SELECTOR, two horizontal cursors appear on the CRT. The voltage between the reference cursor and the Δ cursor is displayed with "ΔV" on the upper side of the CRT. The voltage becomes "+" when the Δ cursor is above the reference cursor, while it is "-" when the Δ cursor is below the reference cursor.
The cursor selected by the CURSORS REF•Δ•TRACKING switch moves up when the VARIABLES control is turned CW, while it moves down when the control is turned CCW.
To measure the voltage from the GND line, press the GND switch to display the GND line, and align the reference cursor with the GND line. Switch the input coupling mode to DC, and align the Δ cursor with the level to be measured.

ΔV cursor measurement for AC voltage



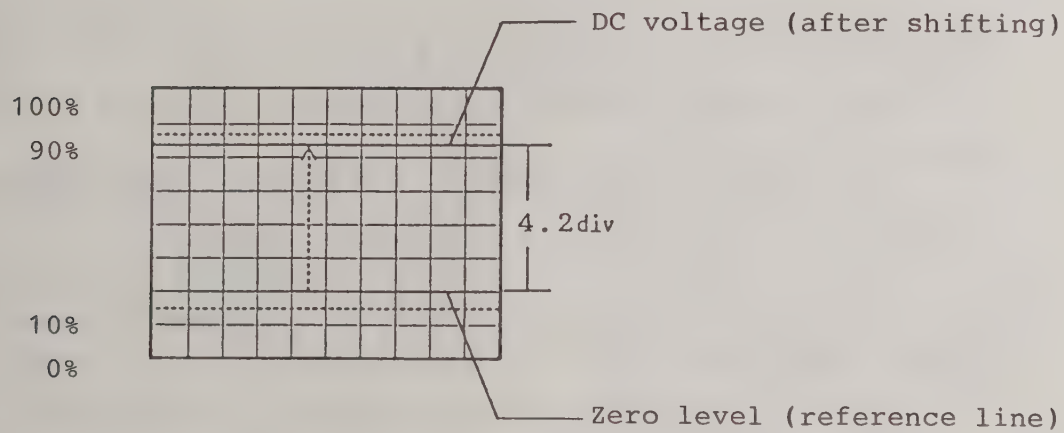
Δ cursor
REF cursor

NOTES:

ⓐ When the VERTICAL MODE switch is set to DUAL, only the measurement value of CH1 (ΔV1) is displayed.

ⓑ When the HORIZONTAL MODE switch is ALT or X-Y, the ΔV cursor cannot be selected.

② Visual measurement



Set the GND switch to GND and obtain the base-line trace. Set the AC-DC switch to DC and set the VOLTS/DIV switch to obtain an optimum amplitude waveform. Since the trace shifts by the amount of DC voltage, the DC voltage of the signal can be obtained by multiplying the shift by the indicated value of VOLTS/DIV. When VOLTS/DIV is 50 mV/DIV, then 50 mV/DIV x 4.2 = 210 mV (However, if a 10x probe is in use, the true value of the signal becomes 10 times the value, it will be 50 mV/DIV x 4.2 x 10 = 2.1 V).

(D) Time and frequency measurement

① ΔT cursor measurement (V-1065 and V-665 only)

When the [MEASURE] is selected by the SELECTOR, the ΔV cursor appears on the CRT.
Then, when the SELECTOR is moved downward once so that the ΔT cursor measurement mode is established, the measurement value will be displayed with ΔT on the upper side of the CRT.
The measurable area by the ΔT cursor is 4 divisions from the center vertical graticule line on the right and left sides.
Set the TIME/DIV switch so that the desired portion of a waveform is as large as possible.
The two cursors selected by the CURSORS REF•Δ•TRACKING switch can be shifted by the VARIABLES control.

The positive or negative polarity corresponds to the two cursor positions;

+: The Δ cursor is located on the right side of the reference cursor.

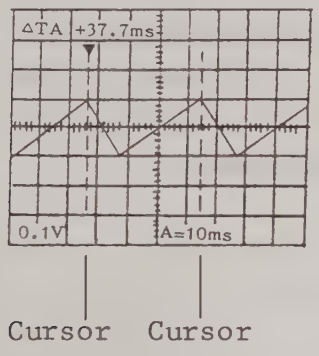
-: The Δ cursor is located on the left side of the reference cursor.

Clockwise rotation of the VARIABLES control moves the cursor to the right; counterclockwise rotation moves it to the left.

NOTES:

ⓐ In ALT or X-Y operation of the horizontal display mode, the ΔT cursor measurement cannot be selected.

ⓑ The measurement value is displayed in divisions when the TIME switch and the VARIABLES control function produce an uncalibrated sweep.
(UNCAL state, CRT display:>)



② 1/ΔT cursor measurement (V-1065 and V-665 only)

When the [MEASURE] is selected by the SELECTOR, two cursors will appear on the CRT. When the SELECTOR is moved down twice, 1/ΔT is displayed on the upper side of the CRT.
When the two cursors are superimposed at two edge points of the one period waveform by the VARIABLES control, the reciprocal number of delta-time between two cursors is displayed with 1/ΔT on the upper side of the CRT.
Clockwise rotation of the VARIABLES control moves the cursor to the right; counterclockwise rotation of the control moves the cursor to the left.

NOTES:

ⓐ In ALT or X-Y operation of the horizontal display mode, the 1/ΔT cursor measurement cannot be selected.

ⓑ The measurement value is displayed in divisions when the TIME switch and the VARIABLES control function produce an uncalibrated sweep.
(UNCAL state, CRT display:>)

③ Visual time measurement

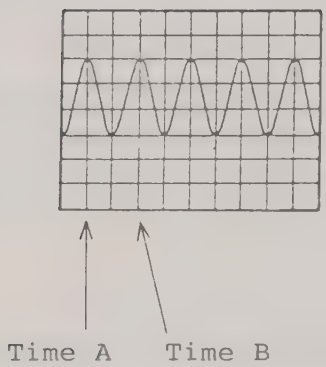
The illustration below shows one period of time between A and B, which represents 2.0 DIV.
When the sweep time is 1 ms/DIV, the period is given by

$$1 \text{ ms/DIV} \times 2.0 = 2.0 \text{ ms}$$
$$(2.0 \times 10^{-3}\text{s})$$

④ Visual frequency measurement

The above result, 2.0 ms $(2.0 \times 10^{-3}\text{s})$, is converted so that the frequency is given by

$$1/(2.0 \times 10^{-3}) = 500 \text{ Hz}.$$

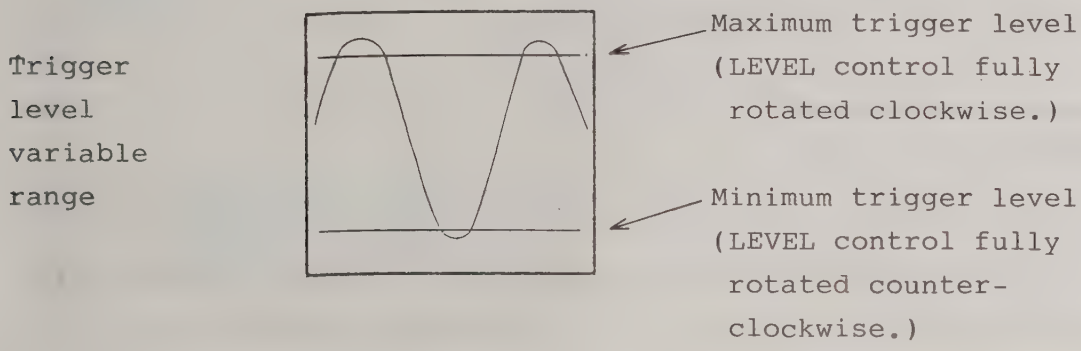


(E) Operation of the AUTO trigger function

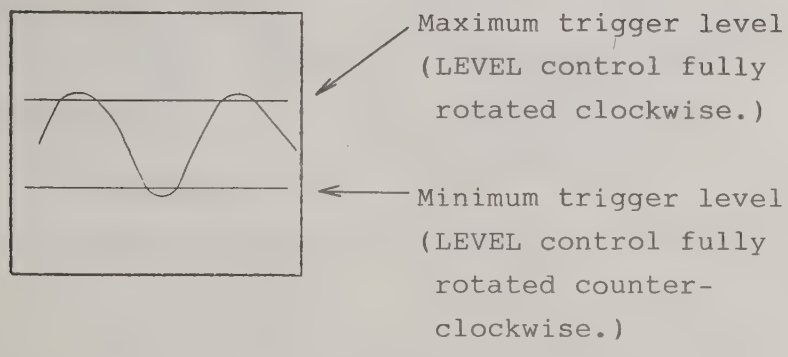
When the TRIGGER MODE switch is set to AUTO, the instrument automatically displays a sweep if an input signal is not applied.

The trigger level is set according to the amplitude of input signal as shown in Figs. (a) and (b).

The AUTO TRIGGER LEVEL setting function eliminates troublesome triggering.


Trigger level variable range
Maximum trigger level (LEVEL control fully rotated clockwise.)
Minimum trigger level (LEVEL control fully rotated counter-clockwise.)

(a) Input signal of large amplitude


Maximum trigger level (LEVEL control fully rotated clockwise.)
Minimum trigger level (LEVEL control fully rotated counter-clockwise.)

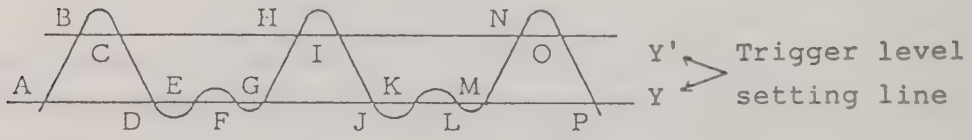
(b) Input signal of small amplitude

When the TRIGGER LEVEL switch is set to NORM, the trigger level is set regardless of the input signal level.

NOTE: When the TRIGGER MODE switch is set to AUTO, it takes 2 or 3 seconds to obtain a stable trigger since the trigger level is automatically set according to the amplitude of an input signal.

(F) Operation of the TRIGGER LEVEL control

In the case shown in Fig. (a) where waveforms are greatly different in amplitude, the waveform is doubled if the TRIGGER LEVEL control is not set properly. In the case where the trigger level is selected by line Y, two waves, one starting with A and advancing to B, C, D, E, F,... and the other starting with E and advancing to F, G, H, I..., will appear alternately on the screen. They will be doubled as shown in Fig. (b).
In such a case, rotate the LEVEL control clockwise until the trigger level comes to Y' line. Then the waveform on the screen becomes the one as shown in Fig. (c) which starts with B and advances to C, D, E, F,... and allows triggering.



(a) Signal waveform

(b) When the trigger setting level is Y

(c) When the trigger setting level is Y'

Triggering of complex waveform

(G) Operation of the HOLDOFF function

① In case of measuring a high frequency signal
Slight jitter may occur on a high frequency signal of 5 MHz approx. or more. In this case adjust the HOLDOFF control so that the jitter is eliminated and a stable trigger is obtained.

② In case of measuring a complex waveform as shown in(a)
It is possible that the triggering is doubled as shown in (b) by the TRIGGER LEVEL control. In such a case, light the HOLDOFF by the SELECTOR and adjust the VARIABLES control to obtain the proper waveform as shown in (c).

(a) Signal waveform

(b) Before using HOLDOFF

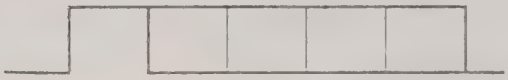
(c) After using HOLDOFF

Triggering of complex waveforms

(H) Operation of the TRIGGER LOCK function

Triggering can be doubled when the sweep range is changed after performing the HOLDOFF adjustment.
In such a case, light the HOLDOFF by the SELECTOR.
When the TRIGGER LOCK lamp is lit with the waveform triggered, the triggering is not doubled if the sweep range is changed.
If the TRIGGER LOCK function is not required, press the TRIGGER LOCK switch again so that the lamp goes off and this function is released.

(a) Waveform triggered by HOLDOFF, etc.



(b) Magnified with TRIGGER LOCK OFF

(c) Magnified with TRIGGER LOCK ON

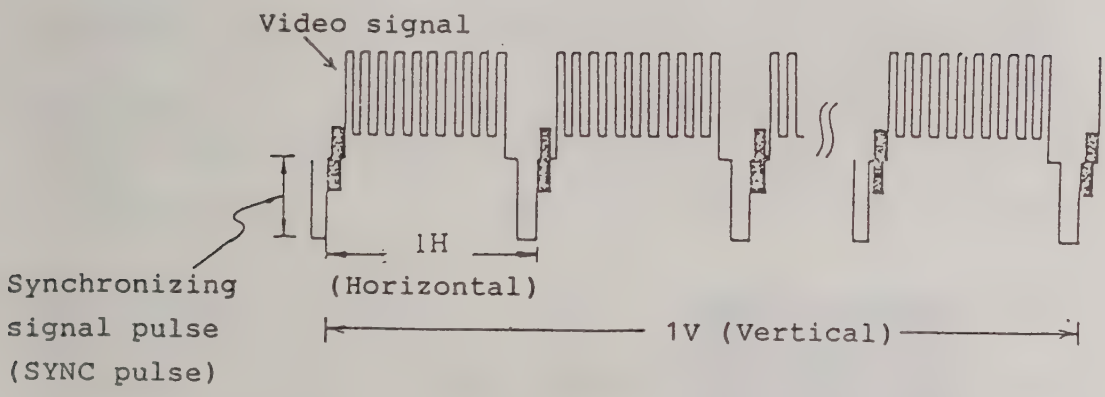
Triggering of complex waveforms

NOTE:

The A TIME/DIV range and the TIME VARIABLE range in the TRIGGER LOCK mode cannot be set to the level slower than that when the signal is locked.

(I) Operation of the TV trigger function

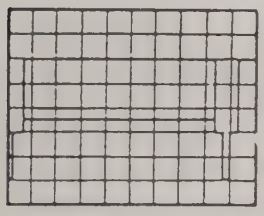
① Video signal of TV



In video work, a composite signal containing a video signal and a sync signal is often measured.

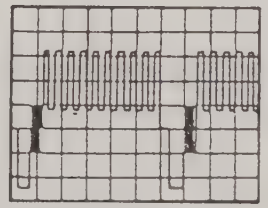
② Operation

To observe a vertical signal



TRIGGER MODE: TV-V

To observe a horizontal signal

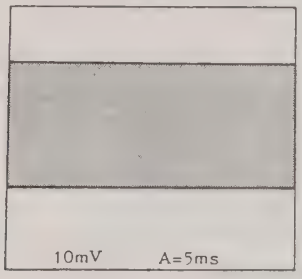


TRIGGER MODE: TV-H

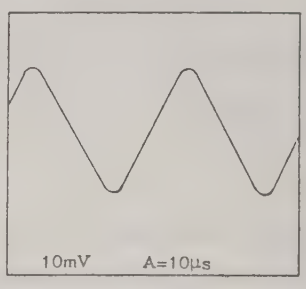
The polarities of the video and sync signals are automatically set. The trigger level setting is not required in the TV mode.

(J) Operation of the AUTO range function

In the normal measurement, the sweep range is set by the TIME/DIV switch. When the AUTO lamp is lit by pressing the AUTO switch with the signal triggered, the input signal is detected, the sweep range is automatically set, and 1.6 to 4 waveforms are displayed on the CRT. This is recommended when the time relation of an input signal is unknown or the input frequency changes with time.



(a) Before using AUTO range



(b) After using AUTO range

NOTES:

ⓐ The AUTO range does not function when the trigger is not obtained. The AUTO range functions with the trigger signal selected by the TRIGGER SOURCE OR X and TRIGGER MODE switches.

ⓑ Since the operable time range is 5 ms/DIV to 50 ns/DIV, the signal of 100 Hz or less, or 8 MHz or more is not displayed as 1.6 to 4 waveforms. The time range is set to 5 ms/DIV for the signal of 100 Hz or less or in case of out of trigger, and set to 50 ns/DIV (maximum) for the signal of 8 MHz approx. or more.

ⓒ The HORIZONTAL MODE switch should be set to A.

(d) When the AUTO range functions with the VERTICAL MODE switch set to DUAL, the dual trace operation is always performed in the CHOP mode. For observing the waveforms at high speed, release the AUTO range function by setting the A AND B TIME/DIV switch to the high speed mode or the low speed mode.

(e) In case of measuring a complex waveform such as a TV signal, it may take several seconds to perform the AUTO range function.

(f) In case of measuring a complex waveform, the time range can be automatically changed and the waveform cannot be measured easily. In this case, release the AUTO range function.

(g) In the X10 MAG mode, the ten times waveforms of 1.6 to 4 cycles are displayed.

(K) Operating procedure of delayed sweep

A delayed sweep is used to magnify any portion of a complex waveform in the horizontal direction.
Press the A switch of the HORIZONTAL MODE, effect triggering by A sweep and set the switches as follows.

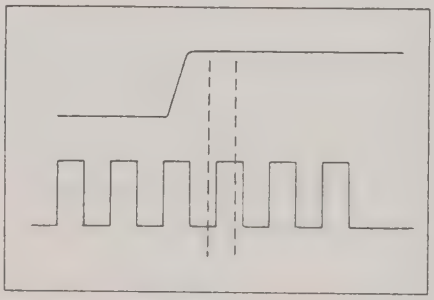
HORIZONTAL MODE : ALT
A TIME/DIV : As desired
B TIME/DIV : Setto the time range to be magnified.

A and B sweeps appear simultaneously on the CRT, [DELAY] is automatically set by the SELECTOR, and the two cursors will appear.
The two cursors will move continuously by the VARIABLES control. Bring the cursors to the position to be magnified. Then, the waveform between the cursors is magnified to occupy the full area of the screen.

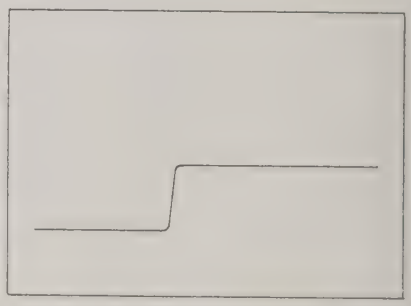
The time from a starting point of the A sweep to that of the B sweep is displayed on the upper side of the CRT.
To measure the magnified waveform only, set the HORIZONTAL MODE to B.

After magnification

Before magnification



(a) HORIZONTAL MODE: ALT



(b) HORIZONTAL MODE: B

The B sweep trace can be shifted vertically about ±3 divisions with respect to the A sweep trace for the convenience of observation by the A/B SEP switch. The vertical variable range is initialized to approx. +2 divisions with respect to the A sweep trace. By setting the VERTICAL MODE to the dual mode in the ALT sweep mode, two more traces, four traces in total, appear on the CRT.

NOTES:

(a) Since traces are alternately displayed in the ALT sweep mode, flicker can occur in the slow sweep rate.
To avoid this, set the TIME/DIV switch to the 0.2 ms/DIV or higher.

(b) The time range of the B sweep is designed to be always higher than that of the A sweep (except in the 50 ns/DIV). When the oscilloscope is used in the ALT or B mode, or when the time range of the A sweep is to be changed, set the HORIZONTAL MODE to A first.

(c) As the magnification ratio increases in the delay sweep mode, the intensity decreases. If the focus of the trace is adjusted to be optimum at this time, a proper focus cannot be obtained for characters, which is not suitable for photographing. Therefore, do not increase the intensity too much, or blank characters for photographing.

(d) The interval between two cursors in the delay sweep mode is designed to be always 0.5 div or more on the CRT, so that easy observation is ensured when the magnification ratio is increased.
Therefore, all the waveform between the cursors is not magnified when the magnification ratio is increased. To verify what part of the A sweep is magnified, check the delay time and the A sweep time displayed on the upper left side of the CRT.

ⓔ Cursors in the ALT sweep mode disappear when the X10 MAG mode is established.

(L) Measurement of transient phenomena

To measure or photograph a single-shot signal and a complex waveform such as an impulse wave, an audio signal, noise from a switch, etc., perform the single sweep operation.

① Single sweep measurement for a waveform to be easily triggered

Set the HORIZONTAL MODE to A, and the TRIGGER MODE to NORM. Connect a vertical signal to be observed or a repetition waveform having the same amplitude as the above signal, and rotate the TRIGGER LEVEL control to obtain a proper triggering.
Select [SINGLE] by the SELECTOR, press the SINGLE RESET switch, and check that the single sweep is performed. Disconnect the vertical signal from the oscilloscope (press the GND switch, for example), press the SINGLE RESET switch again, and check that the SINGLE RESET lamp lights.
When the vertical signal is connected again , the single sweep is performed. At the time, the SINGLE RESET lamp goes off.

② Single sweep measurement for a waveform hard to be triggered

Set the TRIGGER MODE to AUTO, the HORIZONTAL MODE to A, and select [SINGLE] by the SELECTOR.
Press the SINGLE RESET switch so that the single sweep is performed.

NOTES:

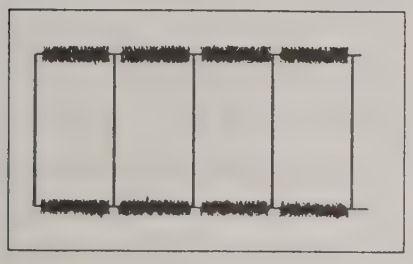
ⓐ If the TRIGGER LEVEL control is rotated, the sweep is performed even when no signal is supplied. After the SINGLE RESET lamp lights, do not rotate the TRIGGER LEVEL control.

ⓑ For a general single shot measurement, set the TRIGGER MODE to NORM.

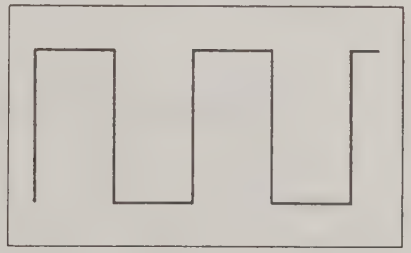
ⓒ When the HORIZONTAL MODE is set to ALT or B, the single sweep cannot be performed.

(M) Operation of the BW LIMIT function

When it is hard to observe or trigger a signal because a high-frequency component is superimposed on the signal, use the BW LIMIT function.
By the BW LIMIT function, the component of approx. 20 MHz or more (for V-1065 and V-1060) or approx. 10 MHz or more (for V-665 and V-660) of the sync signal can be eliminated.



(a) Before the BW LIMIT functions



(b) After the BW LIMIT functions

NOTE:
When the BW LIMIT fucntion is used, the frequency bandwidth is approx. 20 MHz (for V-1065 and V-1060) or approx. 10 MHz (for V-665 and V-660).

(N) High accurate time base calibration

When the power is turned on, the built-in microprocessor automatically starts to calibrate the time base.
To perform a more accurate time base calibration and the waveform measurements which correspond to ambient conditions, turn off the power after fifteen minutes approx. from the power on, and then turn it back to on after three seconds approx.

(O) System reset

In case of abnormal AC power, etc., the built-in microprocessor can malfunction. In this case, press the POWER switch to OFF, and then ON after three seconds or more to reset the microprocessor. Allow 20 seconds for the oscilloscope to be operated after the automatic calibration and diagnosis.

9. HOW TO PHOTOGRAPH THE WAVEFORM

(1) When photographing the scale

Since the oscilloscope is not provided with the scale illumination, the scale cannot be photographed in the normal state. To photograph the scale, perform either of the following methods.

<Raster method>
Connect a 50 kHz sine wave, and set the amplitude of the signal to 8 div on the screen. Set the A TIME/DIV switch to 1 ms and the TRIGGER MODE switch to AUTO. Then the entire screen becomes bright.

<Trace method>
Set the VERTICAL MODE switch to DUAL, the TRIGGER MODE switch to AUTO, and the A TIME/DIV switch to 0.1 ms so that two traces appear.
Increase the brightness of the traces by the INTEN control, and move the two traces to the outside of the screen. Thus the entire screen is brighter than the normal state.

Under the condition that the brightness of the entire screen is increased and the readout display is blanked by the above raster or trace method, photograph the screen first.
Then, display the waveform to be photographed, and photograph the waveform on the same frame with the readout display.

NOTES:

(a) The scale is photographed in black.
(b) When performing the double exposure, fix a camera at the same position to avoid the displacement of the scale and the waveform.

10. SPECIFICATIONS

	V-1065
o CRT	
Graticule	6-inch screen with internal graticule 0%, 10%, 90% and 100% markers 8 x 10 DIV (1 DIV = 1cm)
Phosphor	P31
Accelerating potential	17 kV approx.
External intensity modulation	Coupling : DC coupling Voltage : 5 V or more Maximum input voltage : 30 V (DC + AC peak) or 30 Vp-p AC at 1 kHz Bandwidth : DC to 5 MHz
o Vertical deflection system	
Sensitivity	2 mV/DIV to 5 V/DIV ±3% (switchable in 11 step Continuously variable
Bandwidth	DC to 100 MHz -3dB 2 mV/DIV : DC to 20 MHz -3dB AC low pass : 10 Hz
Rise time	3.5 ns approx. 2 mV/DIV : 17.5 ns approx.
Delay time	Leading edge can be monitored
Maximum input voltage	400 V (DC + AC peak) at 1 kHz or less
Input coupling	AC, DC, GND
Input impedance	1 M ohms ±1.5%, 23pF ±3pF
Display modes	CH1, CH2, DUAL, CHOP(250 kHz approx.), ADD(DIF can be established when the CH2 is in the INVE
Bandwidth limiting function	20 MHz
Polarity selection	± (CH2 only)
Common-mode rejection ratio	20 dB minimum at 20 MHz

	V-1060	V-665	V-660
	←	←	←
	←	←	←
	←	←	←
	←	←	←
	←	12 kV approx.	←
	←	←	←
or less	←	←	←
s)	←	←	←
	←	←	←
	←	60 MHz	←
	←	10 MHz	←
	←	←	←
	←	5.9 ns approx.	←
	←	35 ns approx.	←
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	←	←	←
	←	←	←
F mode RT mode.)	←	←	←
	←	10MHz	←
	←	←	←
	←	10 MHz	←

	V-1065
X-Y operation	X-axis, Y-axis selectable
Sensitivity	X axis : CH1, CH2 2 mV to 5 V/DIV ±3% EXT 0.1 V/DIV ±5% EXT÷10 1 V/DIV ±5% Y axis : 2 mV to 5 V/DIV ±3%
Phase error	3° or less from DC to 50 kHz
X bandwidth	DC to 500 kHz (-3 dB)
o Horizontal deflection system	
Trigger mode	Trigger, auto trigger
Sweep mode	Main sweep, continuous delay sweep, alternate single sweep
Trigger source	CH1, CH2, EXT (AC,DC,DC÷10), LINE
TV trigger	Exclusive sync separator circuit provided Sync polarity: -
Trigger Sensitivity	
NORM mode	
AUTO mode	
TV mode	Sync signal Internal sync : 1 div or more External sync : 200 mVp-p or more
Trigger level	Variable range AUTO: Automatically corres trigger signal NORM: INT : ±4 DIV or more EXT : ±0.4 V or more EXT÷10: ±4 V or more
Slope	±

Frequency	DC to 20 MHz	20 MHz to 100 MHz
INT	0.35 DIV	1.5 DIV
EXT	50 mV	150 mV

Frequency	30 to 100 Hz	100 Hz to 20 MHz	20
INT	1.5 DIV	1 DIV	
EXT	150 mV	100 mV	

	V-1060	V-665	V-660
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sweep,	←	←	←
	←	←	←
	←	←	←
	←	←	←
	←	←	←
	←	DC to 10 MHz	
		10 MHz to 60 MHz	
to 100 MHz		30 to 100 Hz	
1.5 DIV		100 Hz to 10 MHz	
150 mV		10 to 60 MHz	
	←	←	←
onds to the			
	←	←	←
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	←	←	←

<table>
<tr><th></th><th>V-1065</th></tr>
<tr><td>External input impedance</td><td>1 M ohms ±5%, 25pF + 6pF</td></tr>
<tr><td>External input voltage</td><td>400 V (DC + AC peak) at 1 kHz</td></tr>
<tr><td>Sweep time
A(main) sweep

B(delay) sweep</td><td>50 ns/DIV to 0.5 s/DIV
Continuously variable (UNCAL)
50 ns/DIV to 50 ms/DIV</td></tr>
<tr><td>Accuracy</td><td><table><tr><th></th><th>10 to 35°C</th><th>0 to 50°C</th></tr><tr><td>X1</td><td>±3%</td><td>±4%</td></tr><tr><td>MAG X10</td><td>±4%</td><td>±6%</td></tr></table></td></tr>
<tr><td>Sweep magnification</td><td>X10</td></tr>
<tr><td>Maximum sweep rate</td><td>5 ns/DIV</td></tr>
<tr><td>Hold off time</td><td>Variable</td></tr>
<tr><td>Delay time</td><td>1 µs to 5 s</td></tr>
<tr><td>Delay jitter</td><td>1/20,000 or less</td></tr>
<tr><td>Alternate separation</td><td>Variable</td></tr>
<tr><td>Trigger lock function</td><td>Provided</td></tr>
<tr><td>Auto range function</td><td>Provided</td></tr>
<tr><td>Single sweep function</td><td>Provided</td></tr>
<tr><td>o Readout function

Panel setting display</td><td>Vertical axis : V/DIV (CH1, CH2), UNCAL, probe

Sweep speed : S/DIV, UNCAL, MAG (converted valu
Other : Delay time</td></tr>
<tr><td>o Cursor readout function</td><td>Voltage difference ΔV : Δ-REF
Time difference ΔT : Δ-REF
Frequency 1/ΔT : Δ-REF</td></tr>
</table>

	V-1060	V-665	V-660
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conversion e)	Not provided ←	Same as V-1065 ←	Not provided ←
	←	←	←
	No cursor	Same as V-1065	No cursor

	V-1065
o External output	
TRIGGER SIGNAL OUT	Output voltage : 25 mV/DIV approx. (Full scale on the CRT) 50-ohm termination Frequency response: DC to 10 MHz Output impedance : 50 ohms approx.
o Calibrator	
Waveform	1 kHz ±20%, square wave
Voltage	0.5 V ±1%
o Power supply	90 V to 250 V AC, 48 to 440 Hz, 40 W approx.
o Others	
Dimensions	275(W) x 130(H) x 360(D) mm approx. (10.8(W) x 5.1(H) x 14.2(D) in. approx.)
Weight	6 kg approx. (13.2 lb. approx.)
Ambient temperature	Operating : 0 to 50 °C (32 to 122 °F) Safe operating : 10 to 35 °C (50 to 95°F) Storage : -20 to 70°C (-4 to 158°F)
Humidity	Operating mode : 35 to 85% Non-operating mode : 45 to 85%
EMI	VDE0871, Category B

	V-1060	V-665	V-660
	Not provided	Same as V-1065	Not provided
	←	←	←
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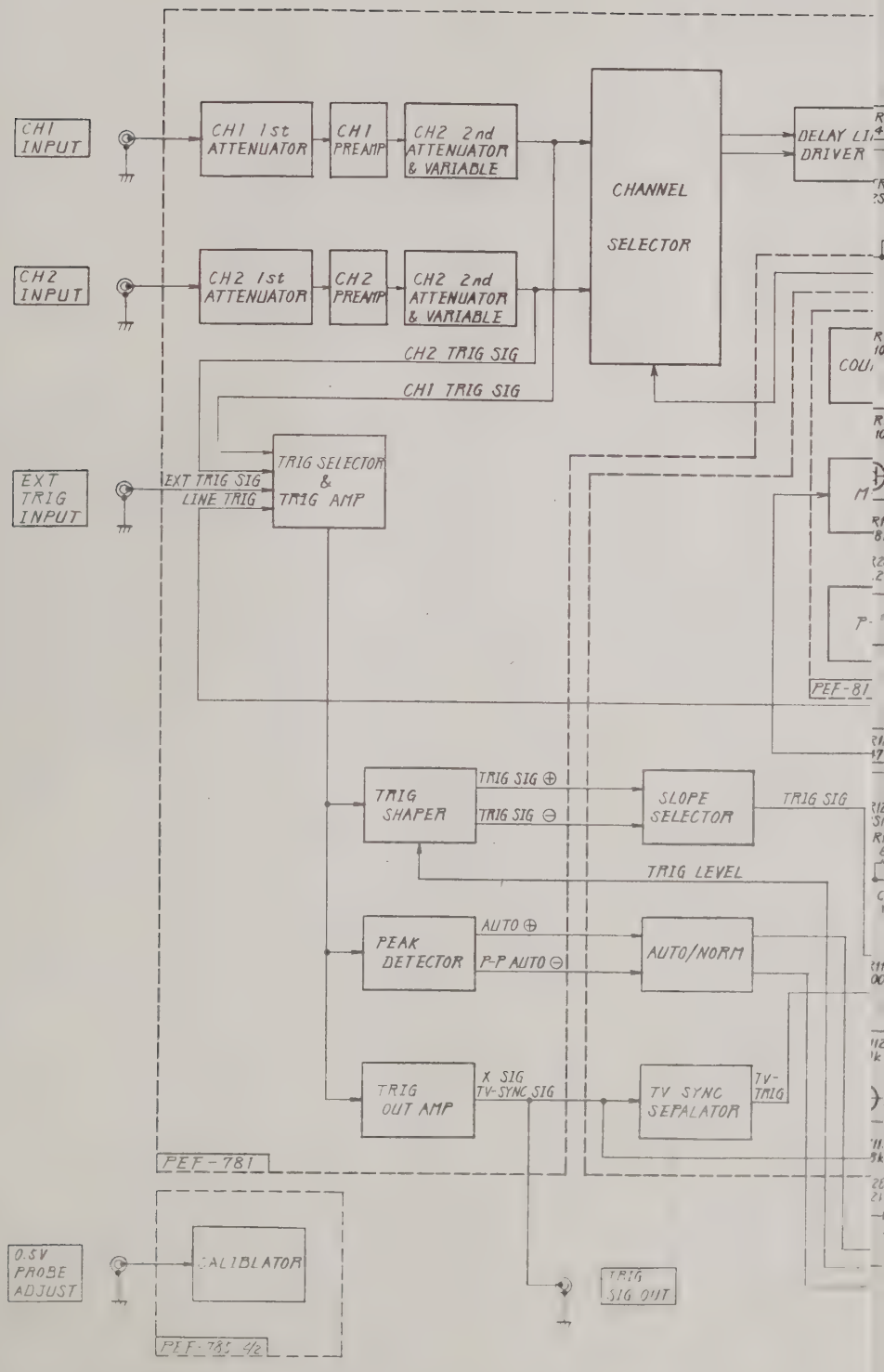
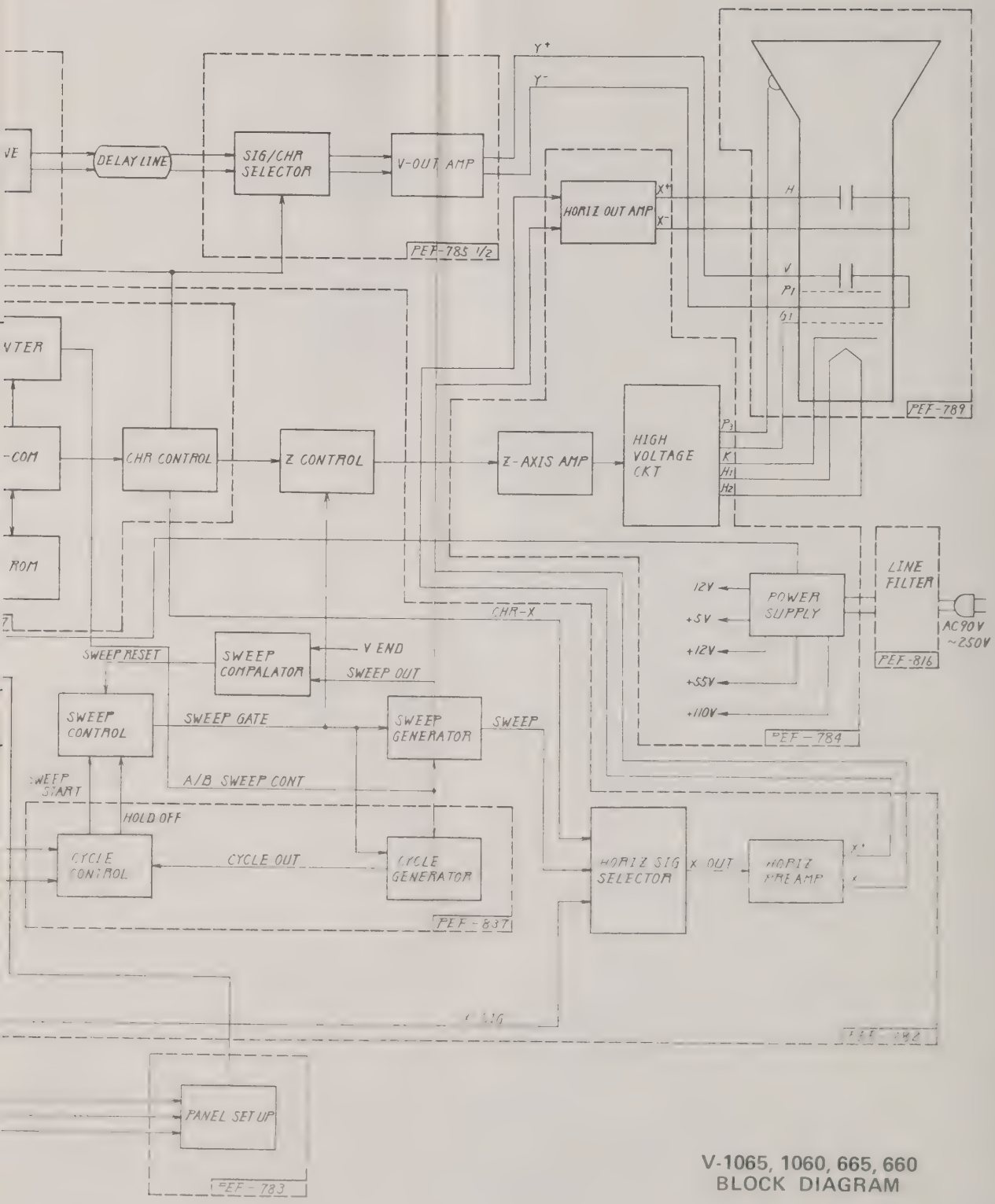
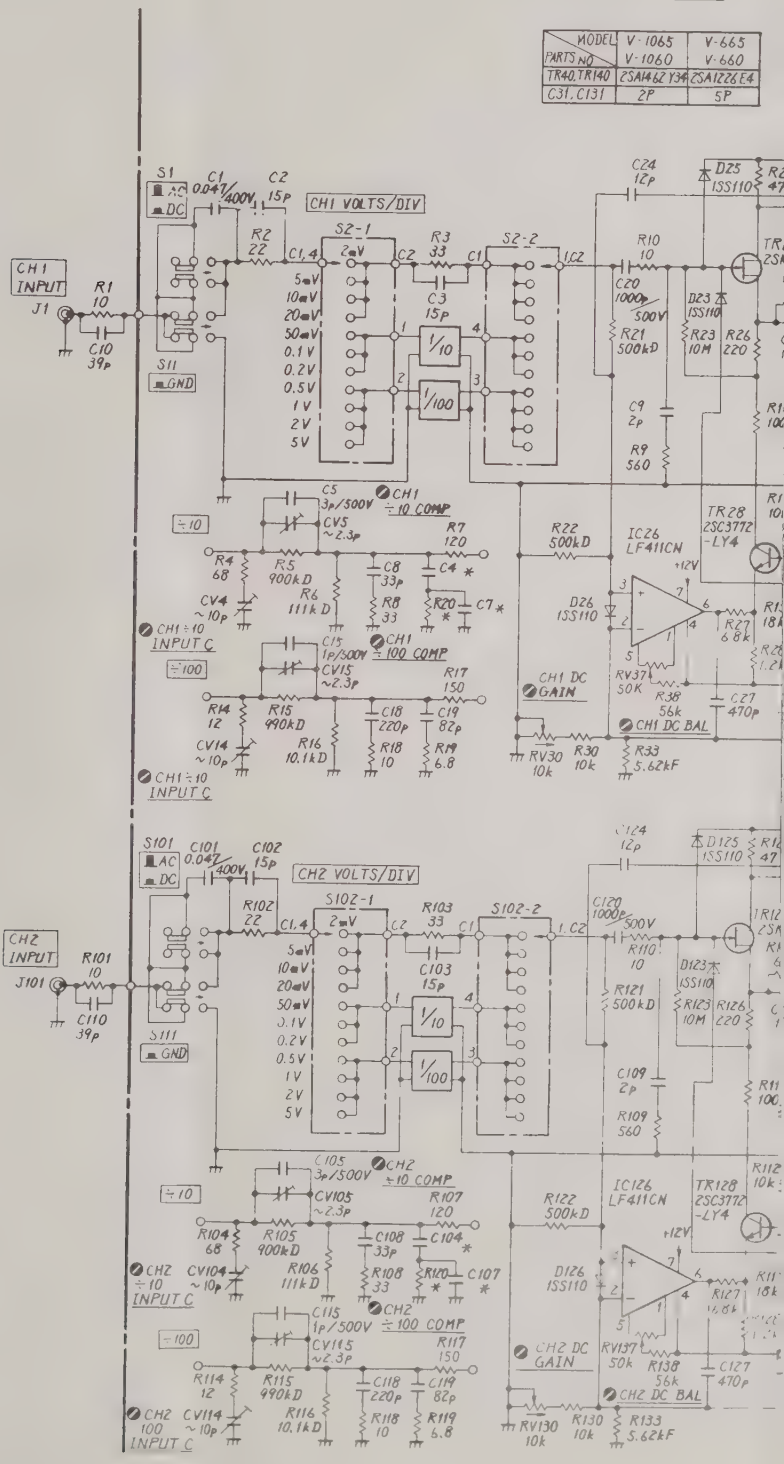
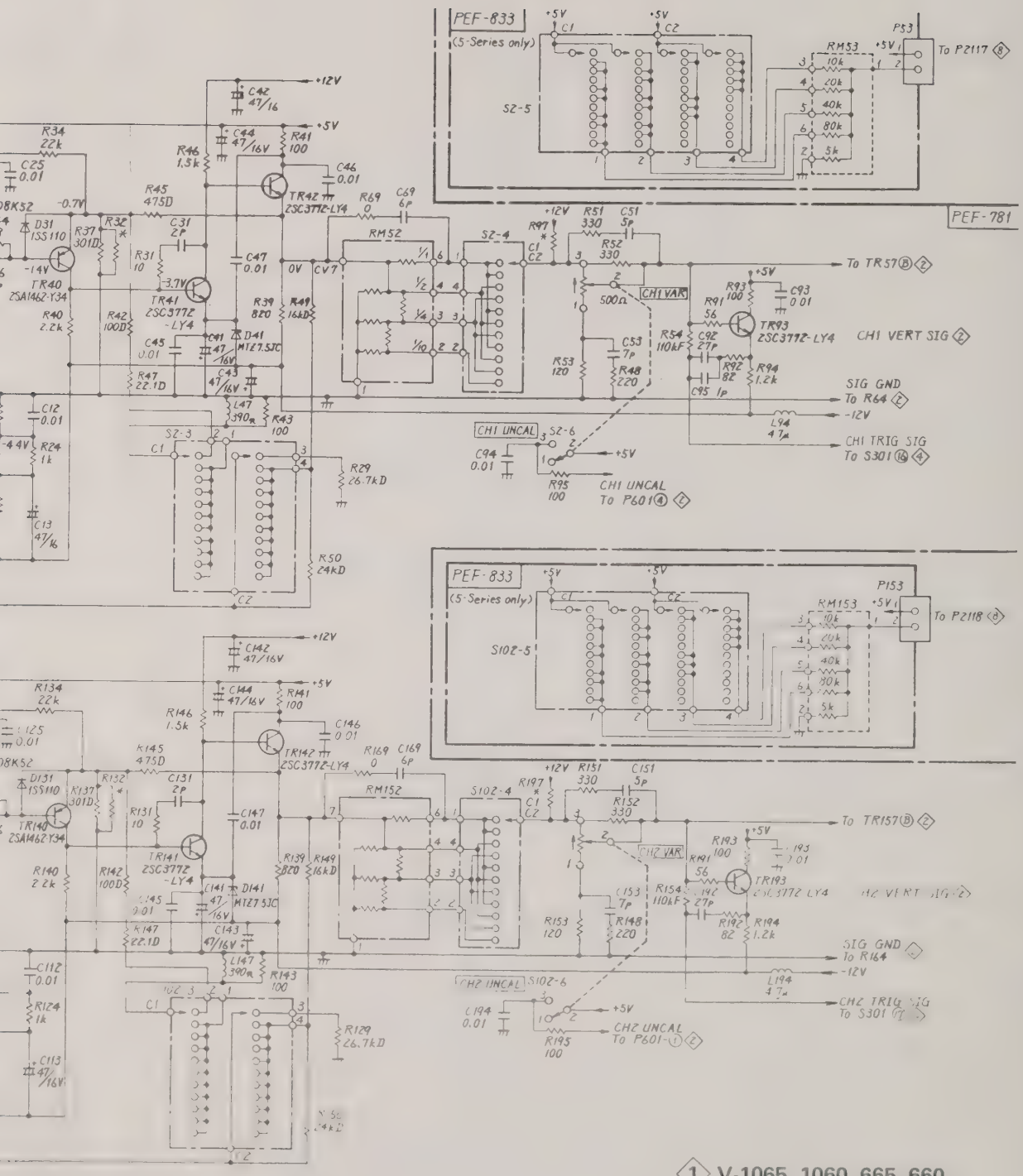

CH1 INPUT
CH1 1st ATTENUATOR
CH1 PREAMP
CH2 2nd ATTENUATOR & VARIABLE
CHANNEL SELECTOR
DELAY LI DRIVER
CH2 INPUT
CH2 1st ATTENUATOR
CH2 PREAMP
CH2 2nd ATTENUATOR & VARIABLE
CH2 TRIG SIG
CH1 TRIG SIG
EXT TRIG INPUT
EXT TRIG SIG
LINE TRIG
TRIG SELECTOR & TRIG AMP
PEF-81
TRIG SHAPER
TRIG SIG ⊕
TRIG SIG ⊖
SLOPE SELECTOR
TRIG SIG
TRIG LEVEL
PEAK DETECTOR
AUTO ⊕
P-P AUTO ⊖
AUTO/NORM
TRIG OUT AMP
X SIG
TV-SYNC SIG
TV SYNC SEPALATOR
TV-TRIG
PEF-781
0.5V PROBE ADJUST
CALIBLATOR
PEF-781 1/2
TRIG SIG OUT



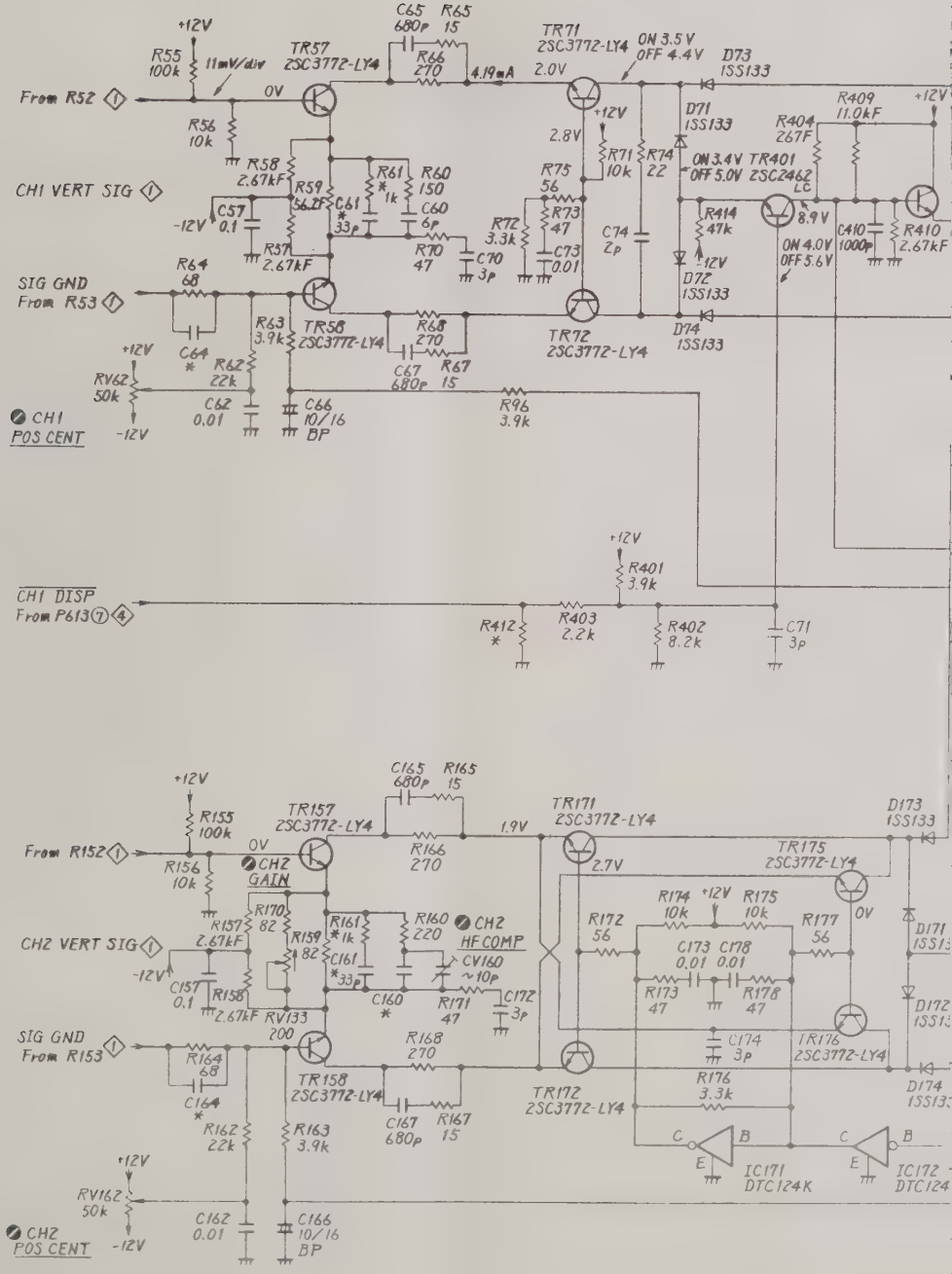
V-1065, 1060, 665, 660
BLOCK DIAGRAM

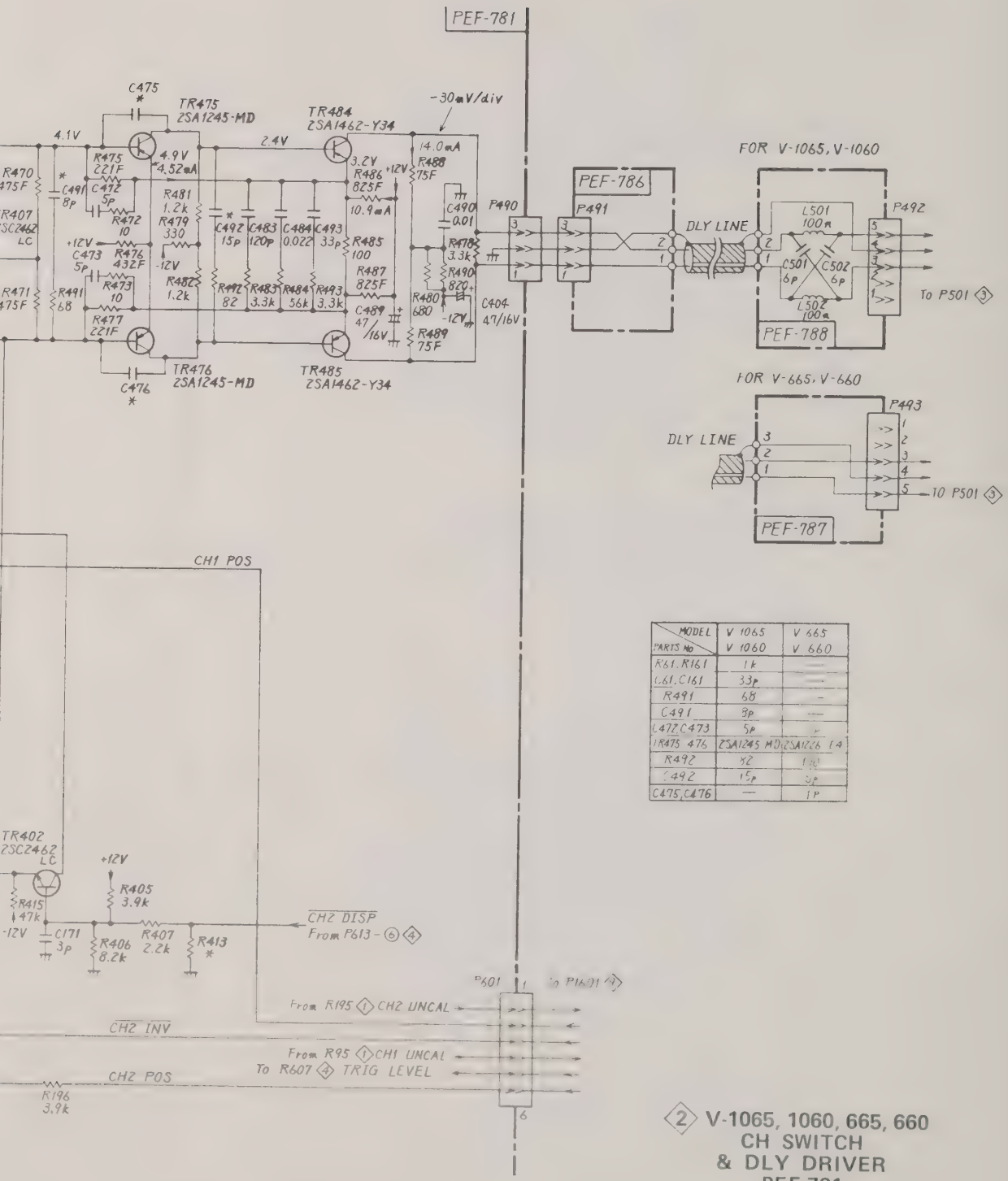
11. SCHEMATIC DIAGRAMS





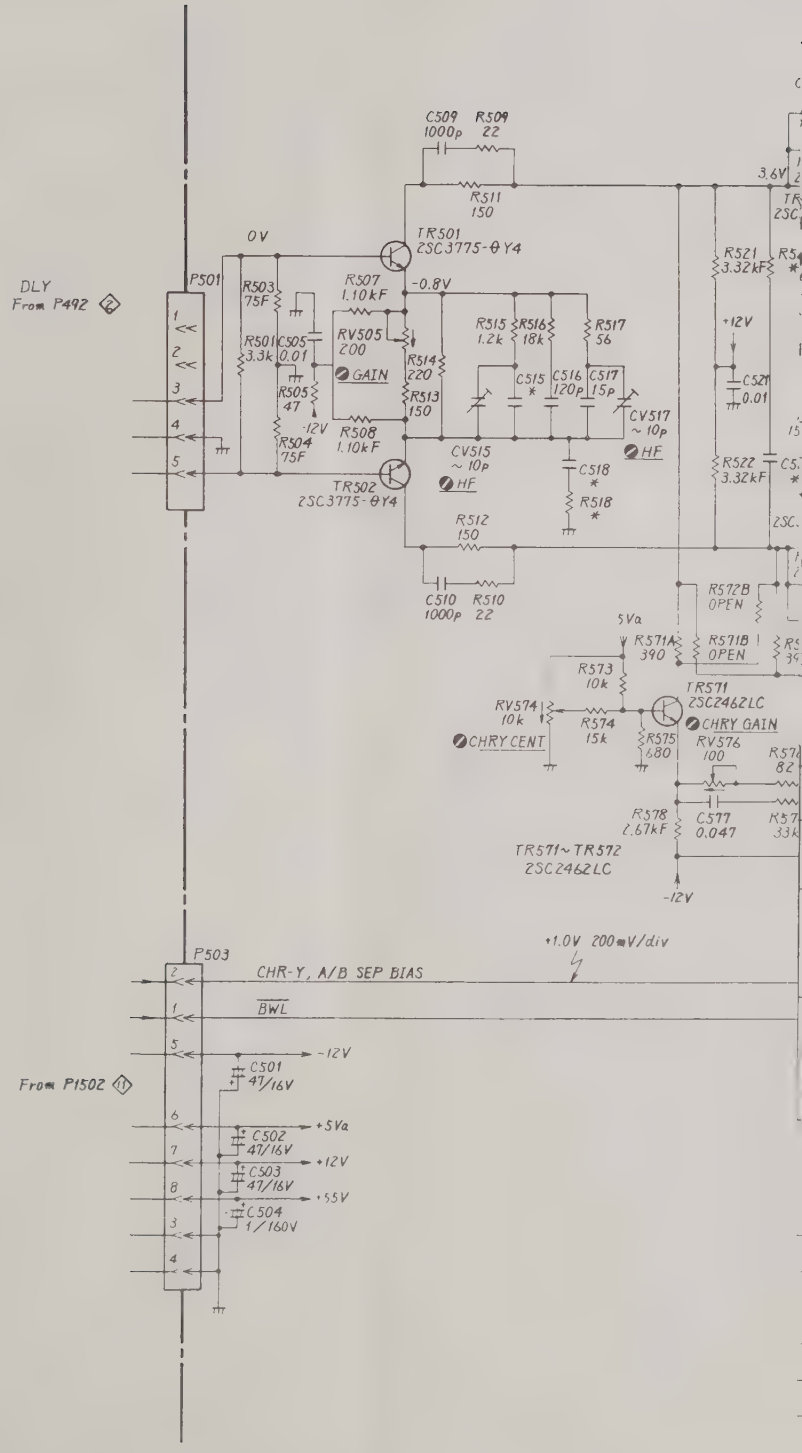
① V-1065, 1060, 665, 660
CH1 & CH2 ATT
PEF-781

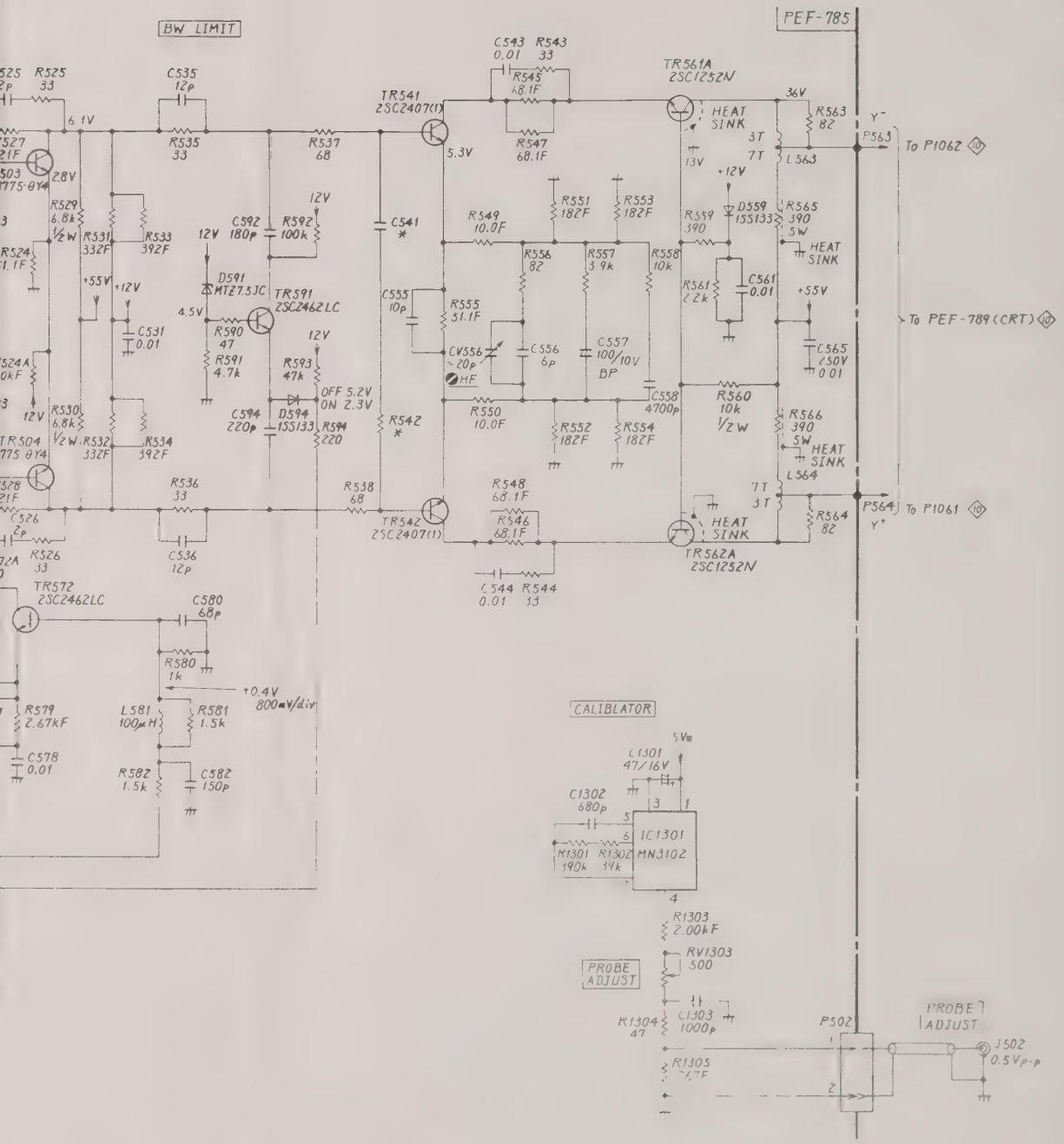

+12V
R55 100k
11mV/div
From R52 1
0V
R56 10k
R58 2.67kF
R59 56.2F
C61 * 33p
R61 * 1k
R60 150
C60 6p
CH1 VERT SIG 1
-12V
C57 0.1
R57 2.67kF
R70 47
C70 3p
R64 68
SIG GND
From R53 1
C64 *
R62 22k
R63 3.9k
TR58 2SC3772-LY4
R68 270
C67 680p
R67 15
+12V
RV62 50k
-12V
CH1 POS CENT
C62 0.01
C66 10/16 BP
R96 3.9k
C65 680p
R65 15
TR57 2SC3772-LY4
R66 270
4.19mA
TR71 2SC3772-LY4
2.0V
ON 3.5V OFF 4.4V
D73 1SS133
2.8V
+12V
R71 10k
R74 22
D71 1SS133
R75 56
R72 3.3k
R73 47
C73 0.01
C74 2p
TR72 2SC3772-LY4
D72 1SS133
D74 1SS133
R409 11.0kF
+12V
R404 267F
ON 3.4V OFF 5.0V TR401 2SC2462 LC
8.9V
R414 47k
12V
ON 4.0V OFF 5.6V
C410 1000p
R410 2.67kF
CH1 DISP
From P613 7 4
+12V
R401 3.9k
R412 *
R403 2.2k
R402 8.2k
C71 3p
+12V
R153 100k
From R152 1
0V
CH2 GAIN
R156 10k
R170 82
R157 2.67kF
R159 82
R161 * 1k
R160 220
CH2 HF COMP
CV160 ~10p
CH2 VERT SIG 1
-12V
C157 0.1
R158 2.67kF
RV133 200
C161 * 33p
C160 *
R171 47
C172 3p
SIG GND
From R153 1
R164 68
C164 *
R162 22k
R163 3.9k
TR158 2SC3772-LY4
R168 270
C167 680p
R167 15
+12V
RV162 50k
-12V
CH2 POS CENT
C162 0.01
C166 10/16 BP
C165 680p
R165 15
TR157 2SC3772-LY4
R166 270
1.9V
TR171 2SC3772-LY4
2.7V
TR172 2SC3772-LY4
R172 56
R174 10k
+12V
R175 10k
R177 56
0V
C173 C178 0.01 0.01
R173 47
R178 47
C174 3p
TR175 2SC3772-LY4
TR176 2SC3772-LY4
R176 3.3k
IC171 DTC124K
IC172 DTC124
D173 1SS133
D171 1SS13
D172 1SS13
D174 1SS13



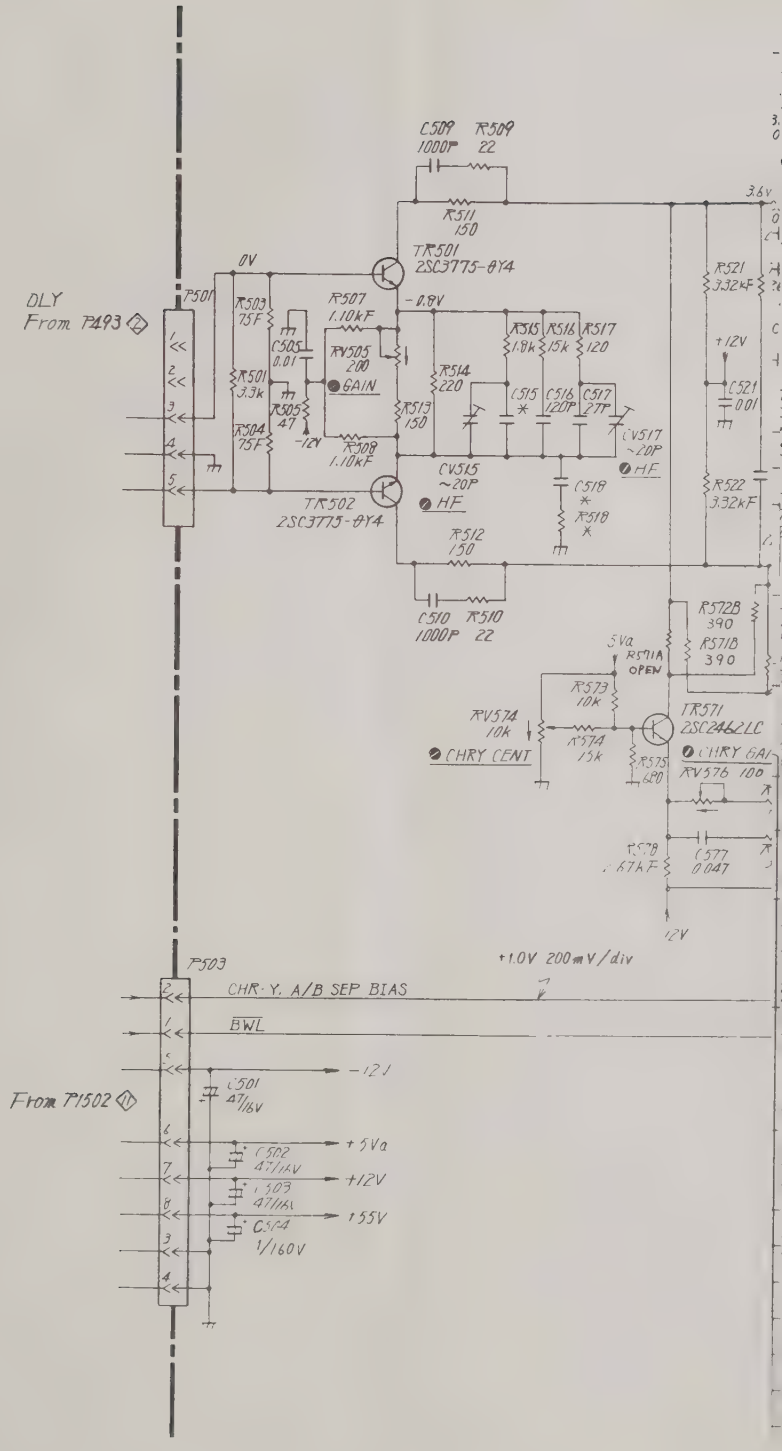
MODEL / PARTS NO	V 1065 V 1060	V 665 V 660
R61, R161	1k	—
C61, C161	33p	—
R491	68	—
C491	8p	—
C472, C473	5p	"
R475, 476	2SA1245-MD	2SA1226-L4
R492	82	180
C492	15p	3p
C475, C476	—	1P

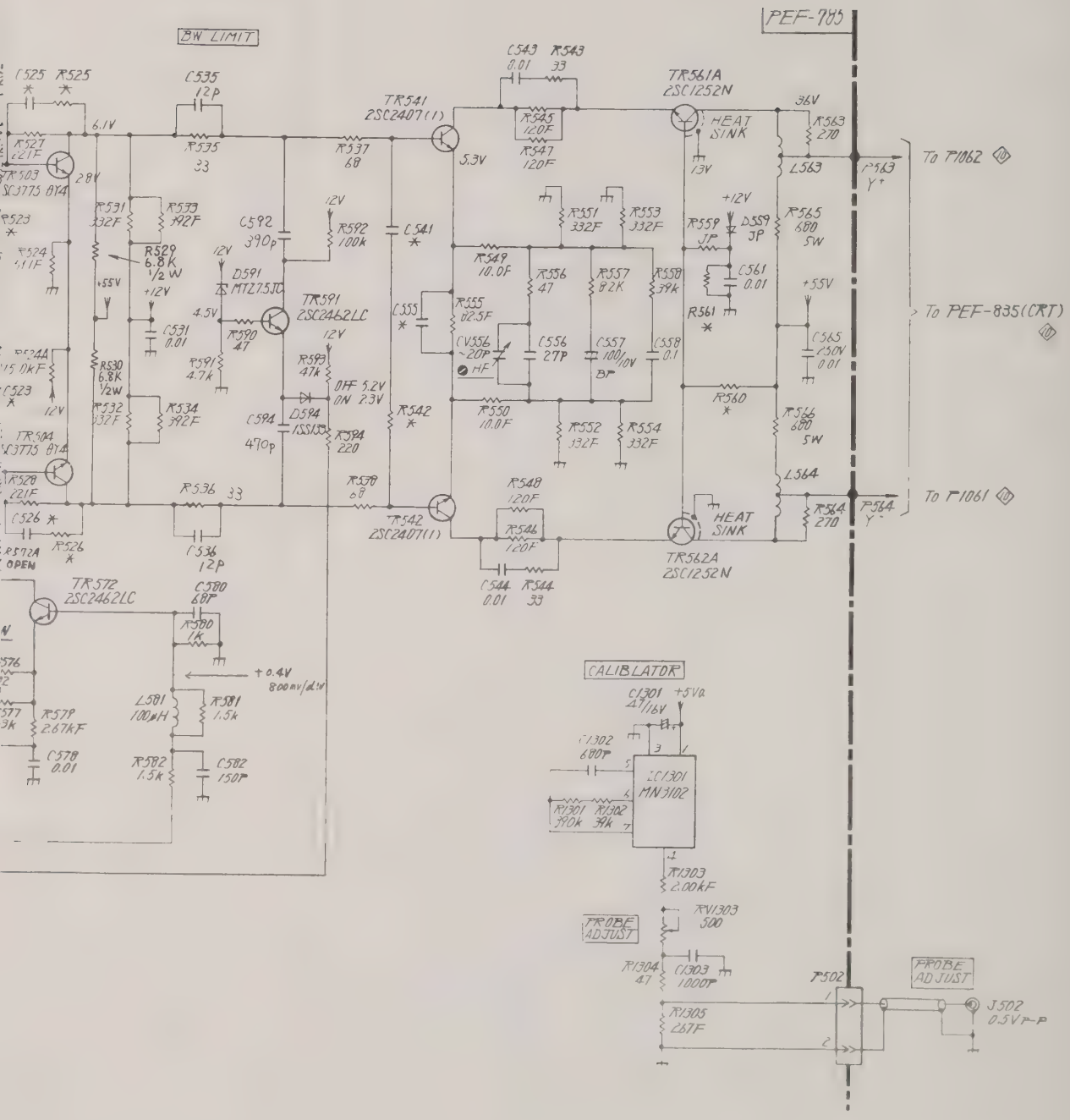
◇2 V-1065, 1060, 665, 660
CH SWITCH
& DLY DRIVER
PEF-781


C509 1000p
R509 22
R511 150
3.6V
TR501 2SC3775-θY4
0V
DLY From P492
P501
R503 75F
R507 1.10kF
-0.8V
R501 3.3k
C505 0.01
RV505 200
GAIN
R514 220
R513 150
R505 47
-12V
R504 75F
R508 1.10kF
TR502 2SC3775-θY4
R515 1.2k
R516 18k
R517 56
C515 *
C516 120p
C517 15p
CV517 ~ 10p
HF
CV515 ~ 10p
HF
C518 *
R518 *
R512 150
C510 1000p
R510 22
R521 3.32kF
+12V
C521 0.01
R522 3.32kF
R572B OPEN
5Va
R571A 390
R571B OPEN
R573 10k
TR571 2SC2462LC
CHRY GAIN
RV574 10k
CHRY CENT
R574 15k
R575 680
RV576 100
R578 2.67kF
C577 0.047
TR571~TR572 2SC2462LC
-12V
+1.0V 200mV/div
P503
CHR-Y, A/B SEP BIAS
BWL
-12V
From P1502
C501 47/16V
+5Va
C502 47/16V
+12V
C503 47/16V
+55V
C504 1/160V

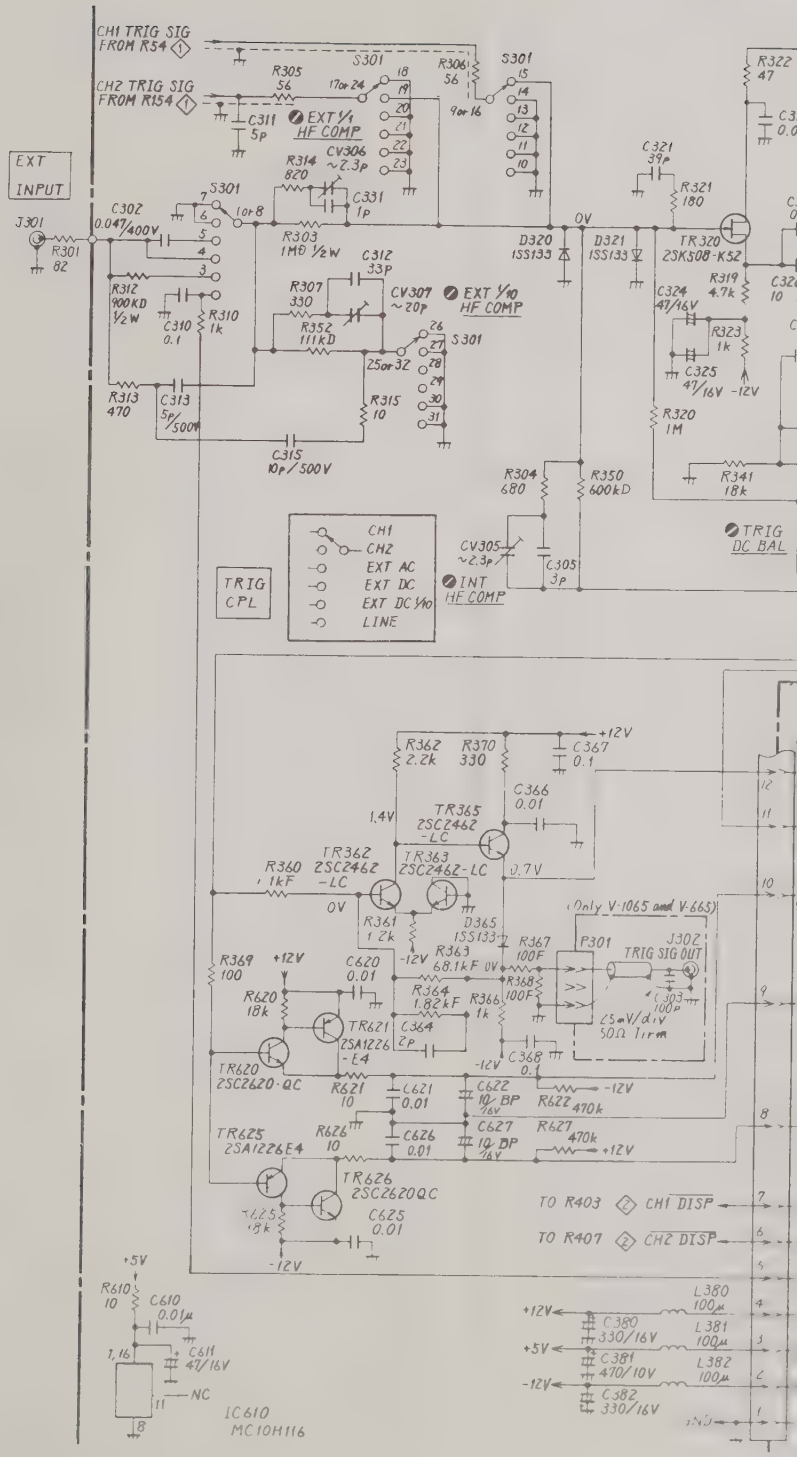


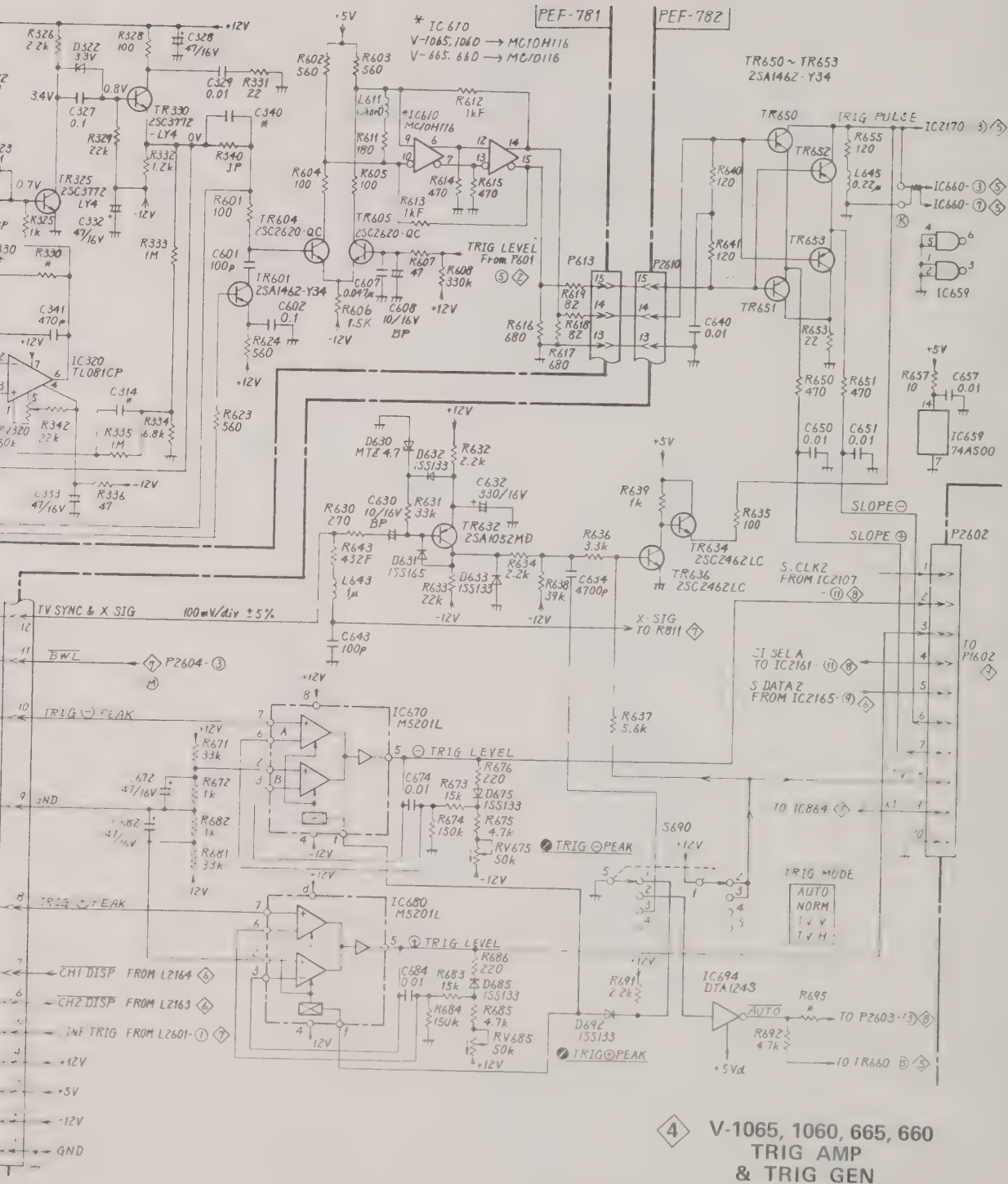
◇3◇ V-1065, 1060
V. OUT AMP
PEF-785


C509 1000P
R509 22
R511 150
3.6V
TR501 2SC3775-BY4
0V
DLY From P493
P501
R503 75F
R501 3.3k
R504 75F
C505 0.01
R505 47
-12V
RV505 200 GAIN
R507 1.10kF
R508 1.10kF
-0.8V
R513 150
R514 220
R515 1.8k
R516 15k
R517 120
C515 *
C516 120P
C517 27P
CV517 ~20P HF
CV515 ~20P HF
C518 *
R518 *
TR502 2SC3775-BY4
R512 150
C510 1000P
R510 22
R521 3.32kF
+12V
C521 0.01
R522 3.32kF
R572B 390
R571B 390
5Va
R571A OPEN
R573 10k
RV574 10k CHRY CENT
R574 15k
TR571 2SC2462LC
R575 680
CHRY GAI
RV576 100
R578 1.67kF
C577 0.047
12V
P503
+1.0V 200mV/div
CHR·Y, A/B SEP BIAS
BWL
-12V
From P1502
C501 47/16V
+5Va
C502 47/16V
+12V
C503 47/16V
155V
C504 1/160V

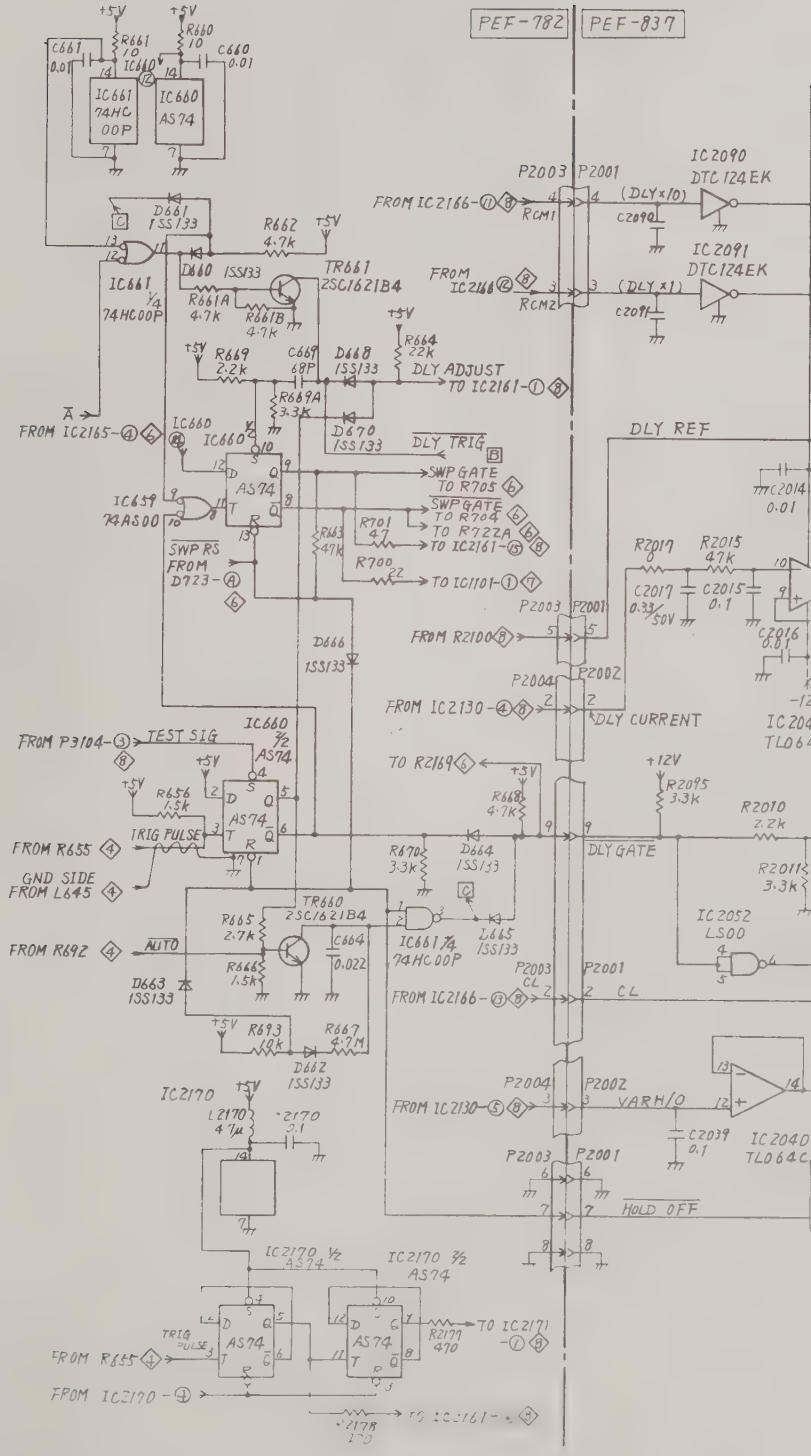


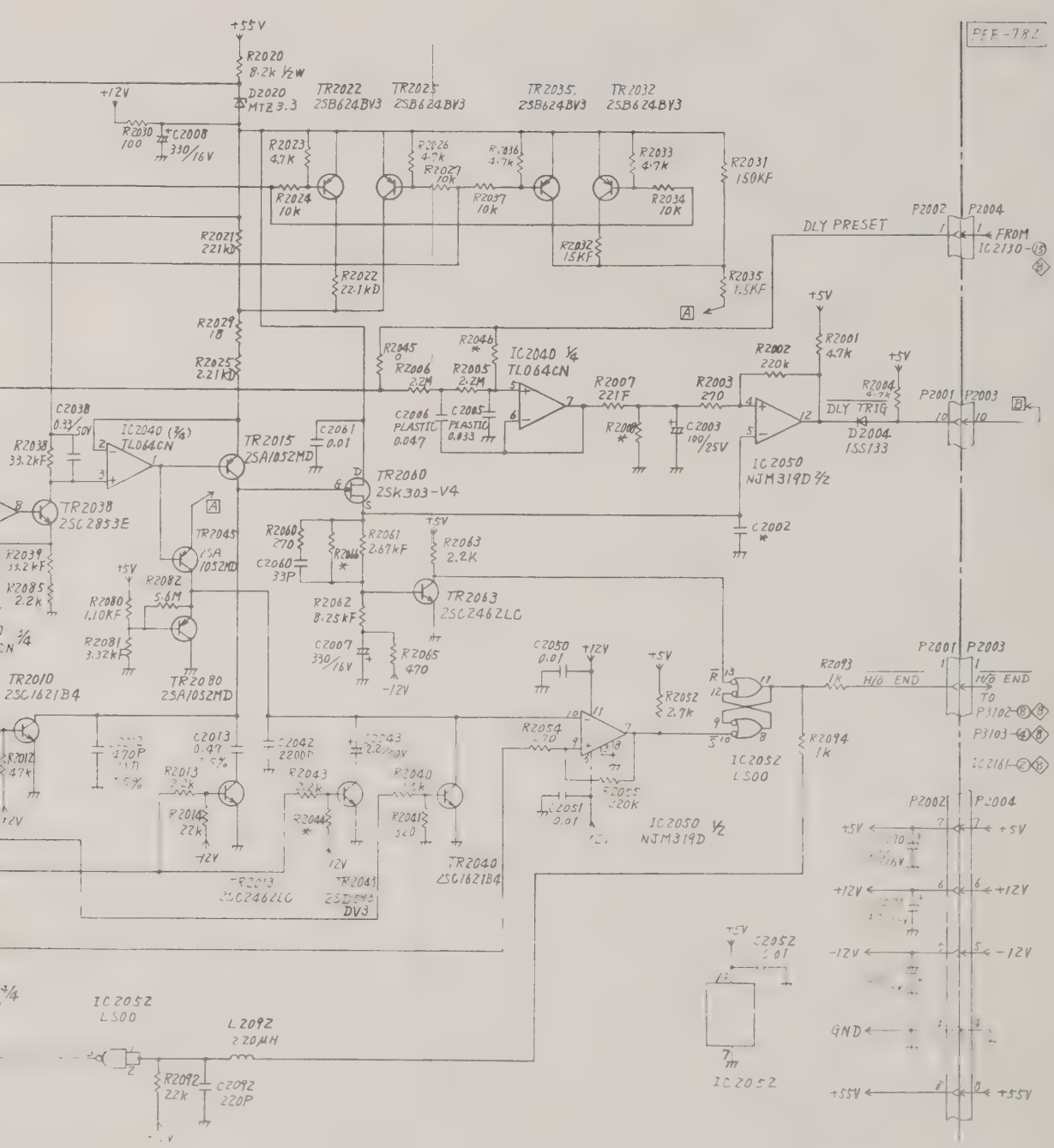
3 V-655, 660
V. OUT AMP
PEF-785


CH1 TRIG SIG FROM R54
CH2 TRIG SIG FROM R154
EXT INPUT
J301
R301 82
S301
R305 56
R306 56
C311 5p
EXT 1/1 HF COMP
R314 820
CV306 ~2.3p
C331 1p
C302 0.047/400V
R303 1MΩ 1/2W
C312 33P
R307 330
CV307 ~20p
EXT 1/10 HF COMP
R352 111kΩ
R312 900kΩ 1/2W
R310 1k
C310 0.1
R313 470
C313 5p/500V
R315 10
C315 10p/500V
D320 1SS133
D321 1SS133
0V
TR320 2SK508-K52
C321 39p
R321 180
R319 4.7k
C324 47/16V
R323 1k
C325 47/16V -12V
R320 1M
R341 18k
R322 47
R304 680
R350 600kΩ
CV305 ~2.3p
C305 3p
INT HF COMP
TRIG DC BAL
TRIG CPL
CH1
CH2
EXT AC
EXT DC
EXT DC 1/10
LINE
R362 2.2k
R370 330
C367 0.1
+12V
C366 0.01
1.4V
TR365 2SC2462-LC
TR363 2SC2462-LC
0.7V
TR362 2SC2462-LC
R360 1kF
R361 1.2k
D365 1SS133
R367 100F
R363 68.1kF
R364 1.82kF
R366 1k
R368 100F
P301
J302 TRIG SIG OUT
C303 100p
25mV/div 50Ω Trm
Only V-1065 and V-663
R369 100
C620 0.01
R620 18k
TR621 2SA1226-E4
C364 2P
TR620 2SC2620-QC
C368 0.1
R621 10
C621 0.01
C622 10/BP/16V
R622 470k
TR625 2SA1226E4
R626 10
C626 0.01
C627 10/BP/16V
R627 470k
TR626 2SC2620QC
R625 18k
C625 0.01
TO R403 CH1 DISP
TO R407 CH2 DISP
+5V
R610 10
C610 0.01μ
C611 47/16V
NC
IC610 MC10H116
L380 100μ
L381 100μ
L382 100μ
C380 330/16V
C381 470/10V
C382 330/16V
GND

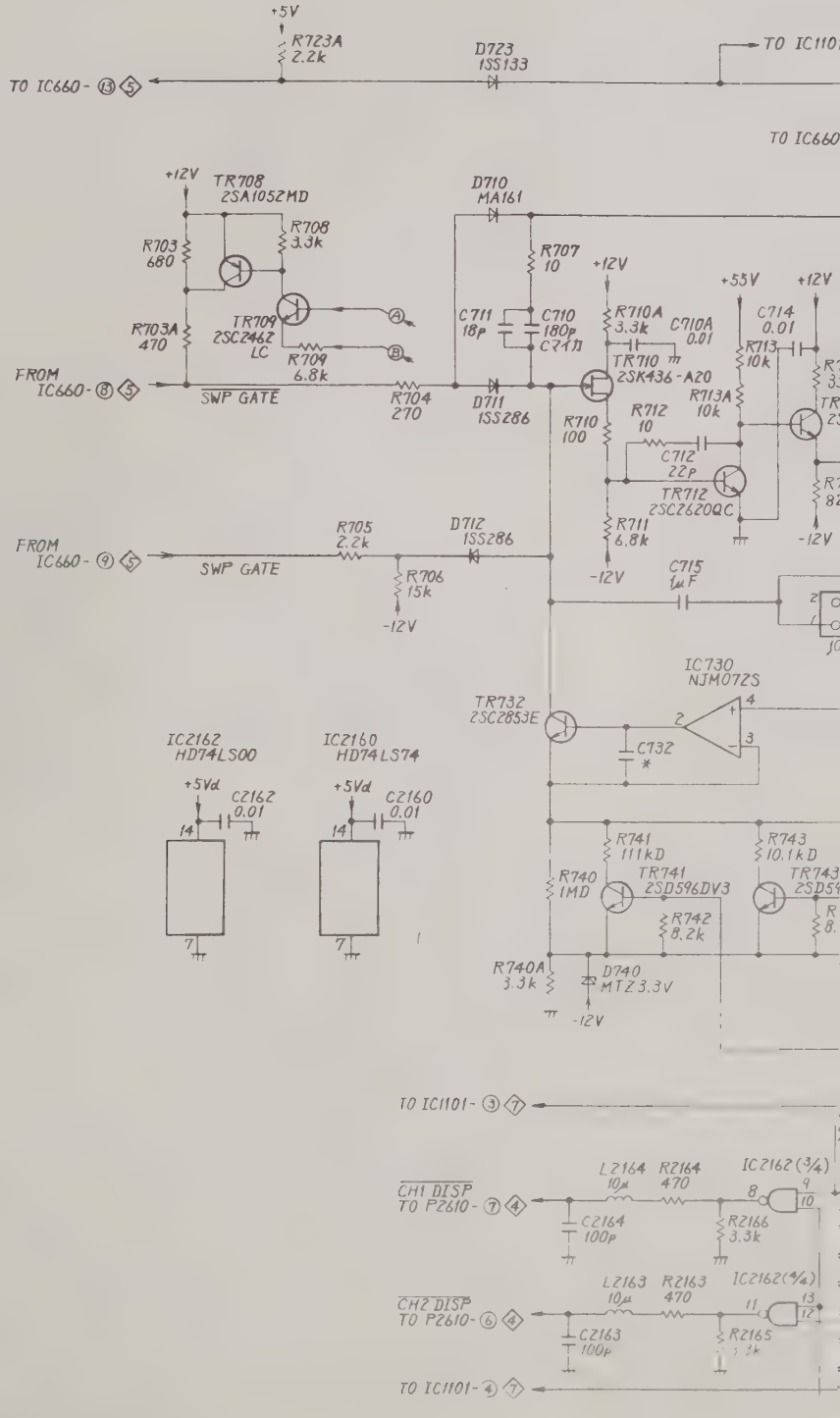


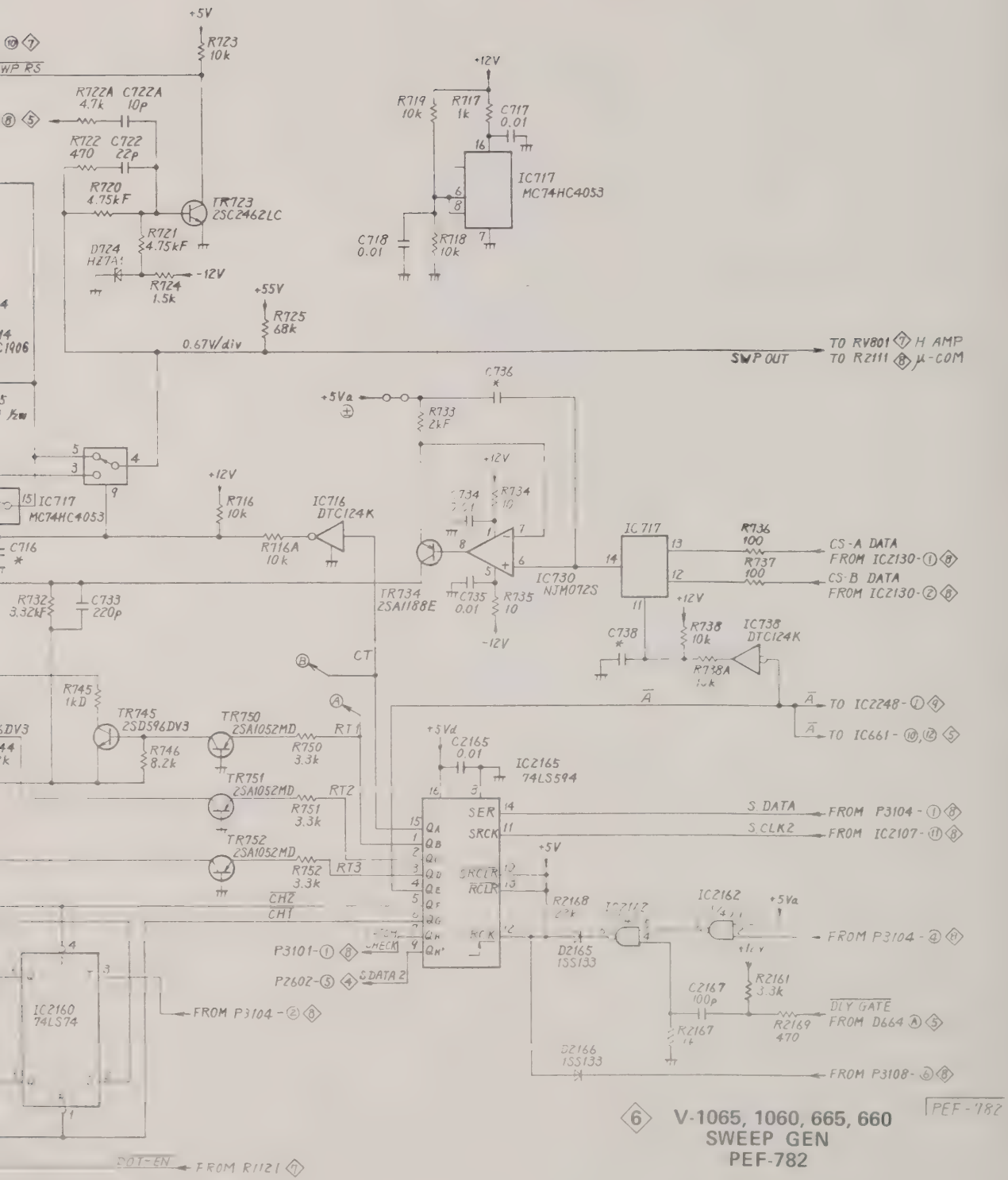
4 V-1065, 1060, 665, 660
TRIG AMP
& TRIG GEN
PEF-781, 782


PEF-782
PEF-837
+5V
R661 10
R660 10
C661 0.01
C660 0.01
IC661 74HC00P
IC660 AS74
D661 1SS133
R662 4.7k
D660 1SS133
TR661 2SC1621B4
R661A 4.7k
R661B 4.7k
IC661 1/4 74HC00P
R664 22k
DLY ADJUST
TO IC2161-①
R669 2.2k
C669 68P
D668 1SS133
R669A 3.3k
D670 1SS133
FROM IC2165-④
IC660
IC659 74AS00
DLY TRIG
SWP GATE TO R705
SWP GATE TO R704
TO R722A
TO IC2161-⑮
R701 47
R700 22
TO IC1101-①
R663 47k
SWP RS FROM D723-④
D666 1SS133
FROM P3104-③
TEST SIG
R656 1.5k
TRIG PULSE
FROM R655
GND SIDE FROM L645
TR660 2SC1621B4
R665 2.7k
C664 0.022
R666 1.5k
FROM R692
AUTO
D663 1SS133
R893 1.2k
R667 4.7M
D662 1SS133
IC2170
L2170 4.7μ
C2170 0.1
IC2170 1/2 AS74
IC2170 2/2 AS74
TRIG PULSE
FROM R655
FROM IC2170-④
R2177 470
TO IC2171-①
C2178
TO IC2161-④
P2003
P2001
FROM IC2166-⑪
RCM1
IC2090 DTC124EK
(DLY x10)
C2090
FROM IC2166-⑫
RCM2
IC2091 DTC124EK
(DLY x1)
C2091
DLY REF
C2014 0.01
R2017 0
R2015 47k
C2017 0.33/50V
C2015 0.1
C2016 0.1
P2002
P2004
FROM R2100
FROM IC2130-④
DLY CURRENT
IC204 TL064
TO R2169
+12V
R2095 3.3k
R2010 2.2k
R668 4.7k
R670 3.3k
D664 1SS133
DLY GATE
R2011 3.3k
IC2052 LS00
IC661 1/4 74HC00P
L665 1SS133
FROM IC2166-③
CL
FROM IC2130-⑤
VARH/O
C2039 0.1
IC2040 TL064C
HOLD OFF



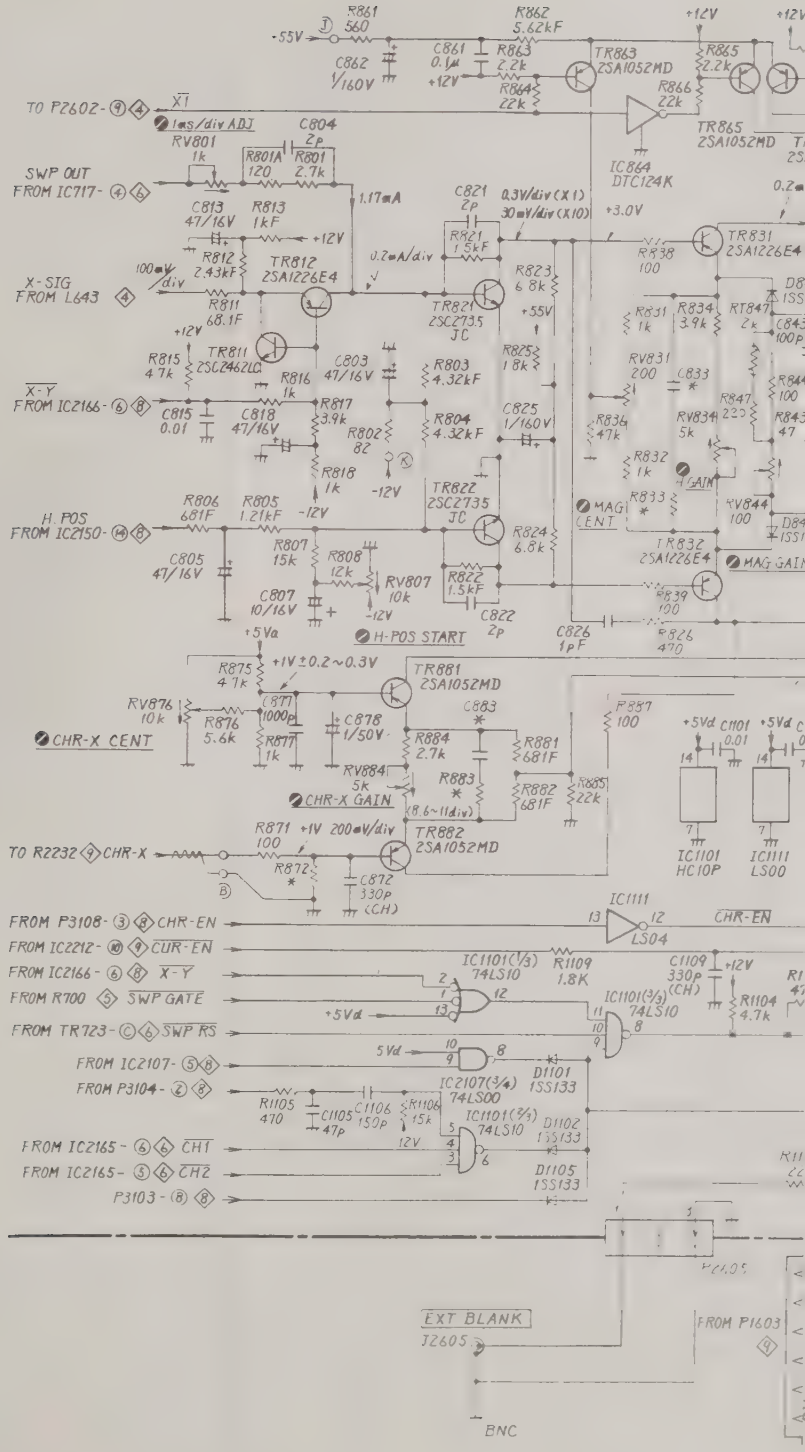
5 V-1065, 1060, 665, 660
CYCLE
PEF-782, 837

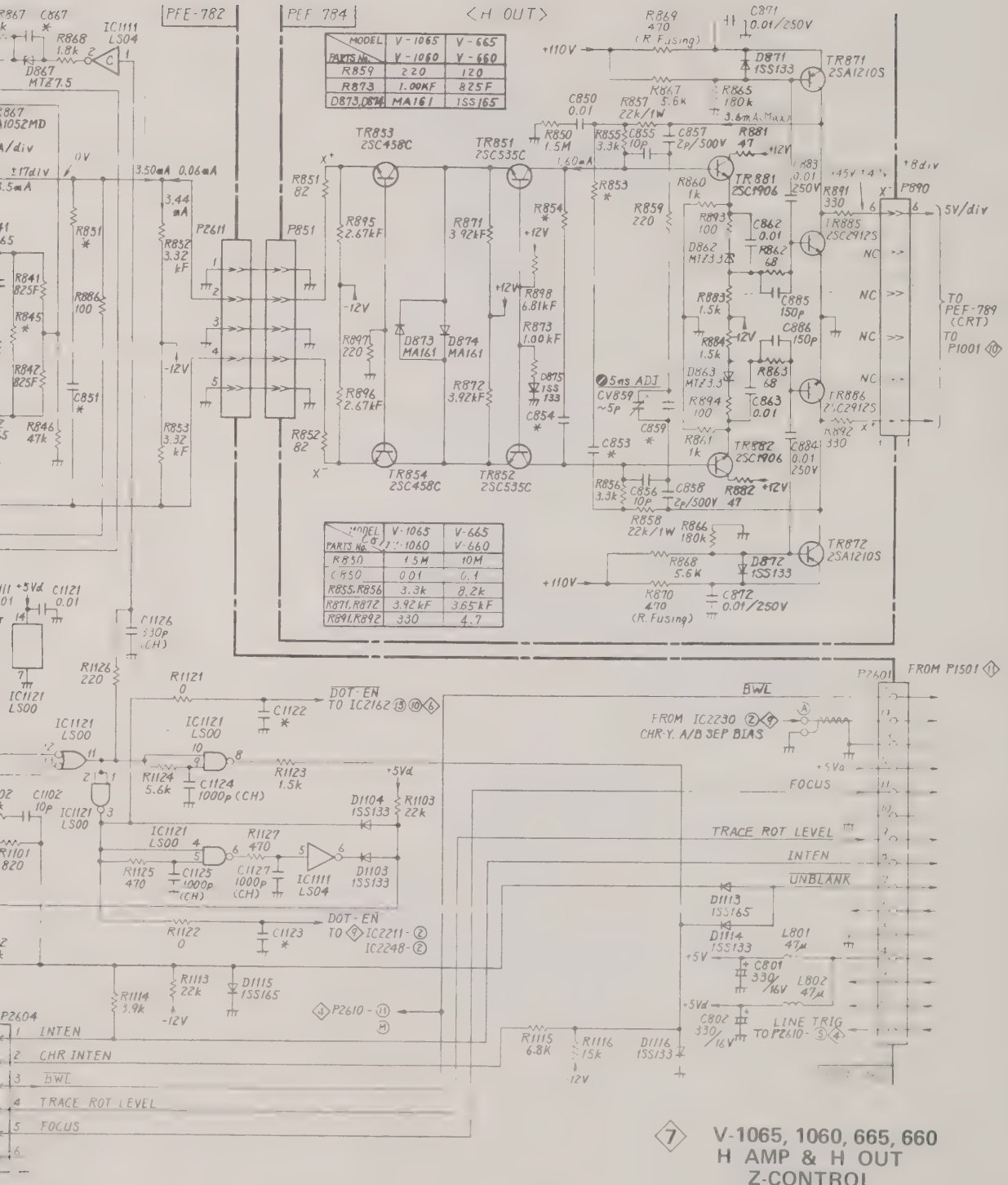

+5V
R723A 2.2k
D723 1SS133
TO IC660- 13 5
TO IC1101
TO IC660
+12V
TR708 2SA1052MD
R708 3.3k
R703 680
R703A 470
TR709 2SC2462 LC
R709 6.8k
FROM IC660- 8 5
SWP GATE
R704 270
D710 MA161
R707 10
C711 18P
C710 180P
C711
R710A 3.3k
C710A 0.01
TR710 2SK436-A20
R710 100
R712 10
C712 22P
TR712 2SC2620QC
R711 6.8k
-12V
+55V
C714 0.01
R713 10k
R713A 10k
FROM IC660- 9 5
R705 2.2k
D712 1SS286
R706 15k
C715 1μF
IC730 NJM072S
TR732 2SC2853E
C732 *
IC2162 HD74LS00
IC2160 HD74LS74
+5Vd
C2162 0.01
C2160 0.01
14
7
R741 111kD
R743 10.1kD
R740 1MD
TR741 2SD596DV3
TR743
R742 8.2k
R740A 3.3k
D740 MTZ3.3V
TO IC1101- 3 7
CH1 DISP TO P2610- 7 4
L2164 10μ
R2164 470
IC2162(3/4)
C2164 100P
R2166 3.3k
CH2 DISP TO P2610- 6 4
L2163 10μ
R2163 470
IC2162(4/4)
C2163 100P
R2165
TO IC1101- 4 7



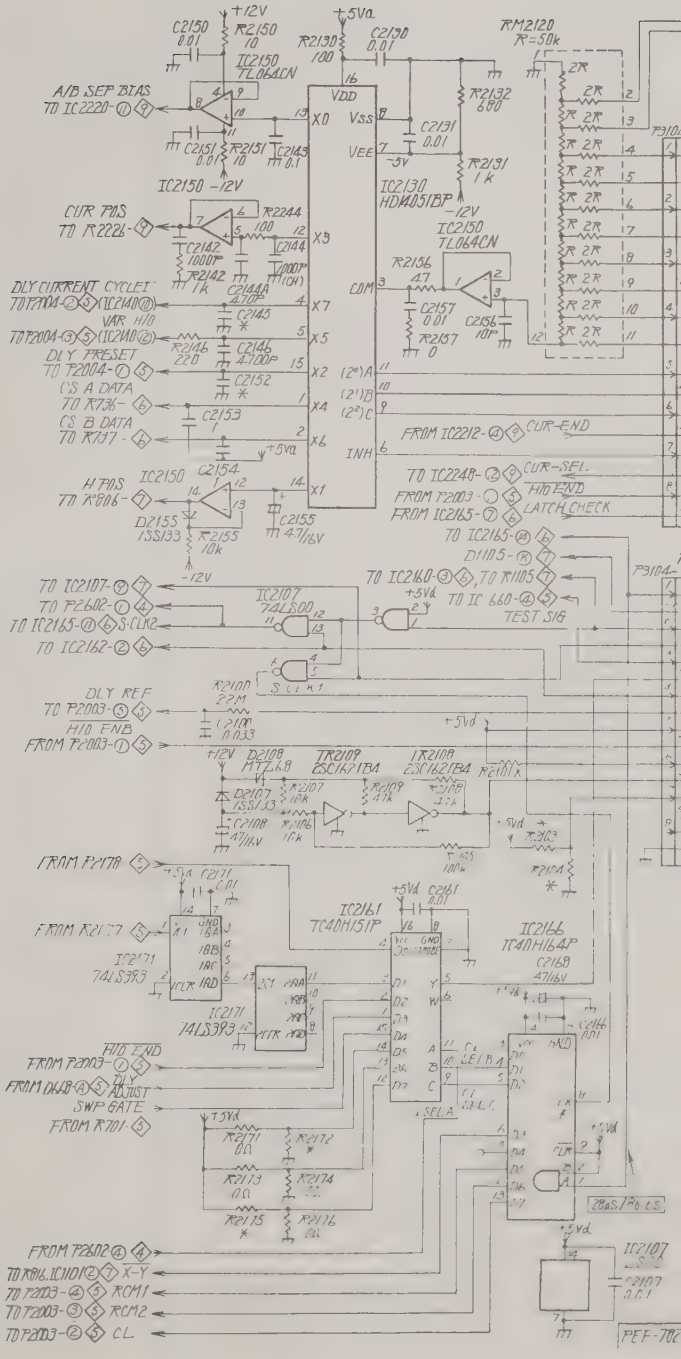
6 V-1065, 1060, 665, 660
SWEEP GEN
PEF-782

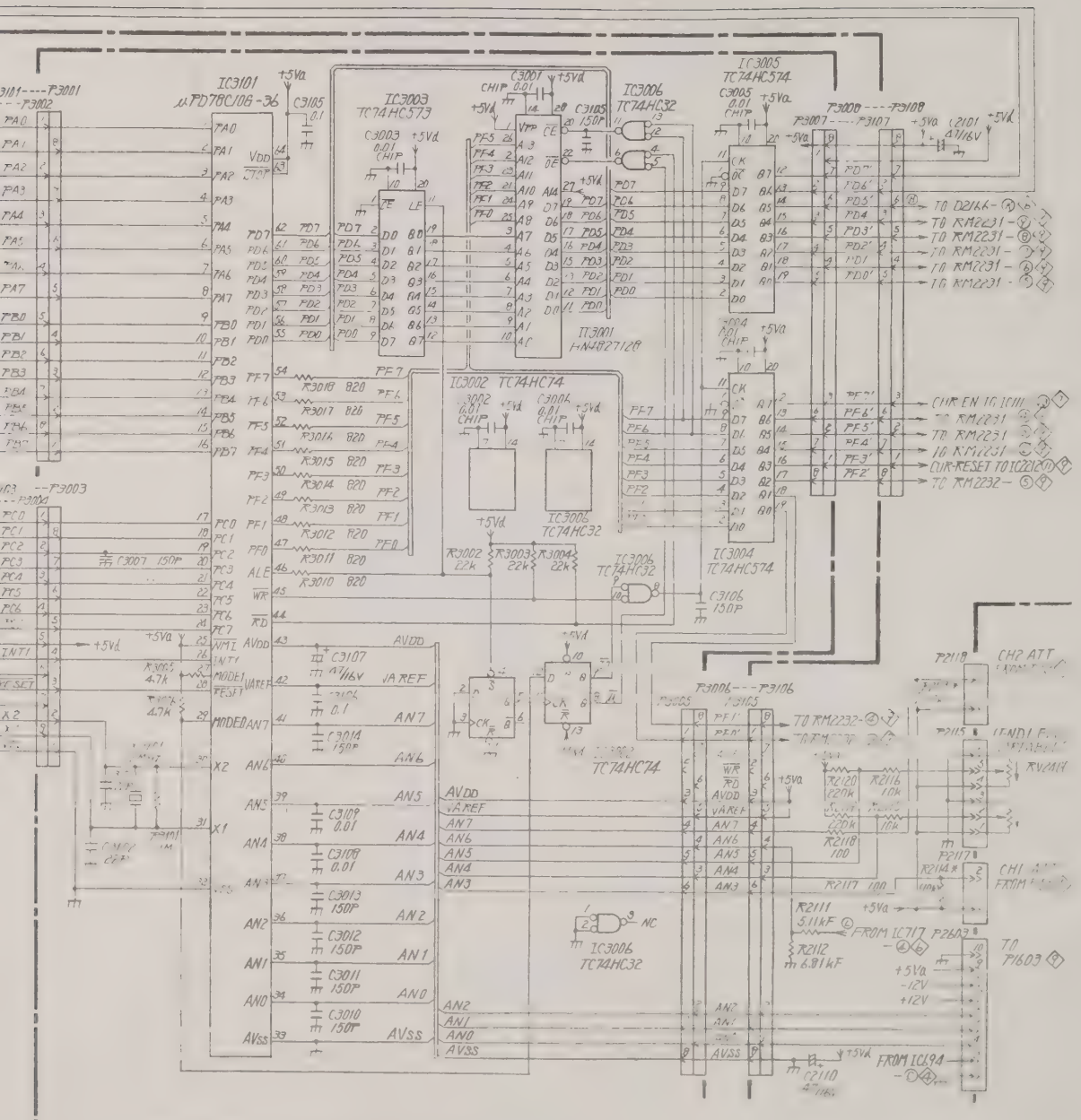
PEF-782


TO P2602-⑨④ X1
1mS/div ADJ
SWP OUT FROM IC717-④⑥
X-SIG FROM L643 ④
X-Y FROM IC2166-⑥⑧
H. POS FROM IC2150-⑭⑧
CHR-X CENT
CHR-X GAIN
TO R2232 ⑨ CHR-X
FROM P3108-③⑧ CHR-EN
FROM IC2212-⑩⑨ CUR-EN
FROM IC2166-⑥⑧ X-Y
FROM R700 ⑤ SWP GATE
FROM TR723-ⓒ⑥ SWP RS
FROM IC2107-⑤⑧
FROM P3104-②⑧
FROM IC2165-⑥⑥ CH1
FROM IC2165-③⑥ CH2
P3103-⑧⑧
EXT BLANK
TO P1603 ⑨
BNC
+12V
+55V
-55V
-12V
+5Vd
+3.0V
+5Va
TR863 2SA1052MD
TR865 2SA1052MD
IC864 DTC124K
TR831 2SA1226E4
TR821 2SC2735 JC
TR822 2SC2735 JC
TR811 2SC2462LC
TR812 2SA1226E4
TR832 2SA1226E4
TR881 2SA1052MD
TR882 2SA1052MD
IC1101 HC10P
IC1111 LS00
IC1101(1/3) 74LS10
IC1101(2/3) 74LS10
IC2107(3/4) 74LS00
IC1111 LS04
0.3V/div (X1)
30mV/div (X10)
0.2mA/div
100mV/div
1.17mA
GAIN
MAG CENT
MAG GAIN
H-POS START

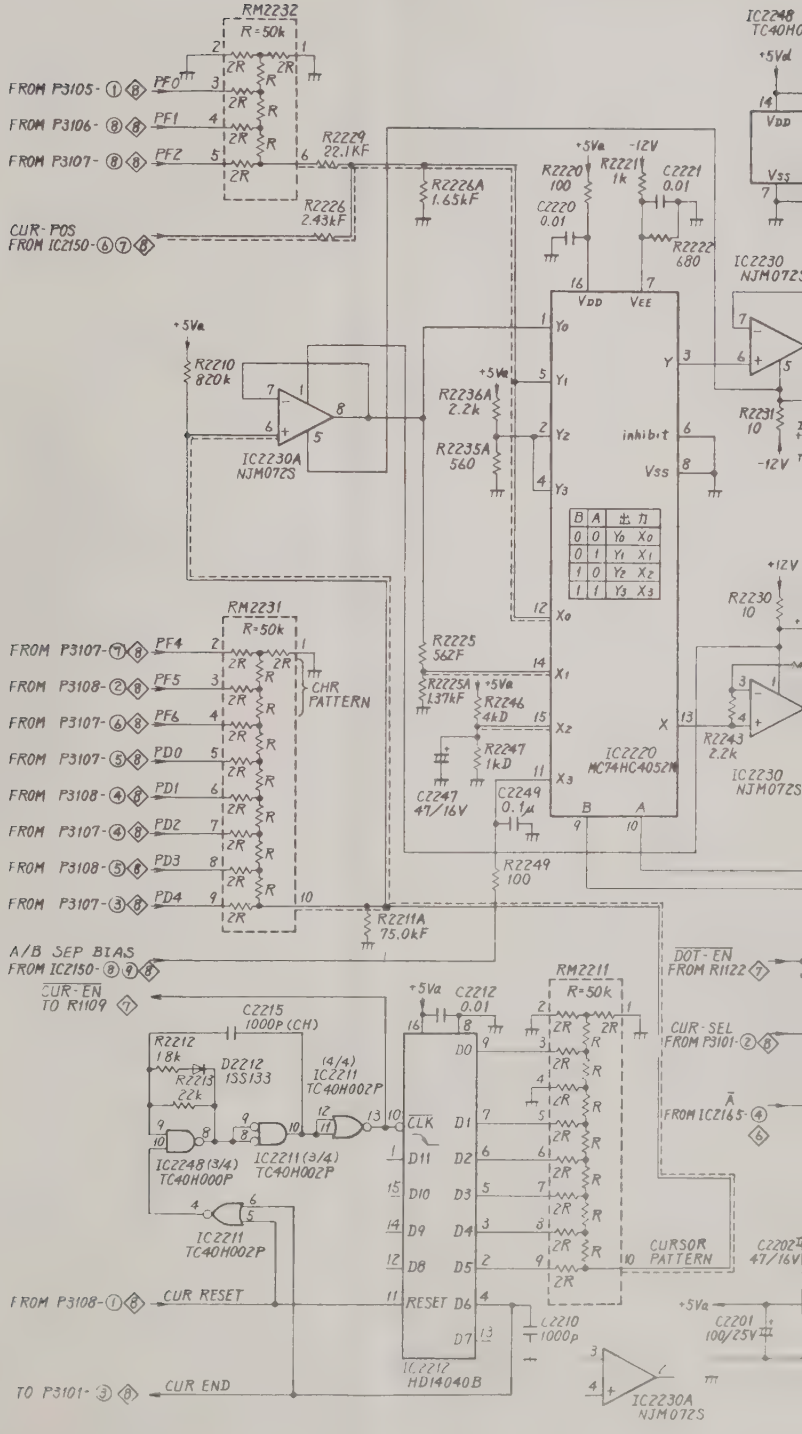


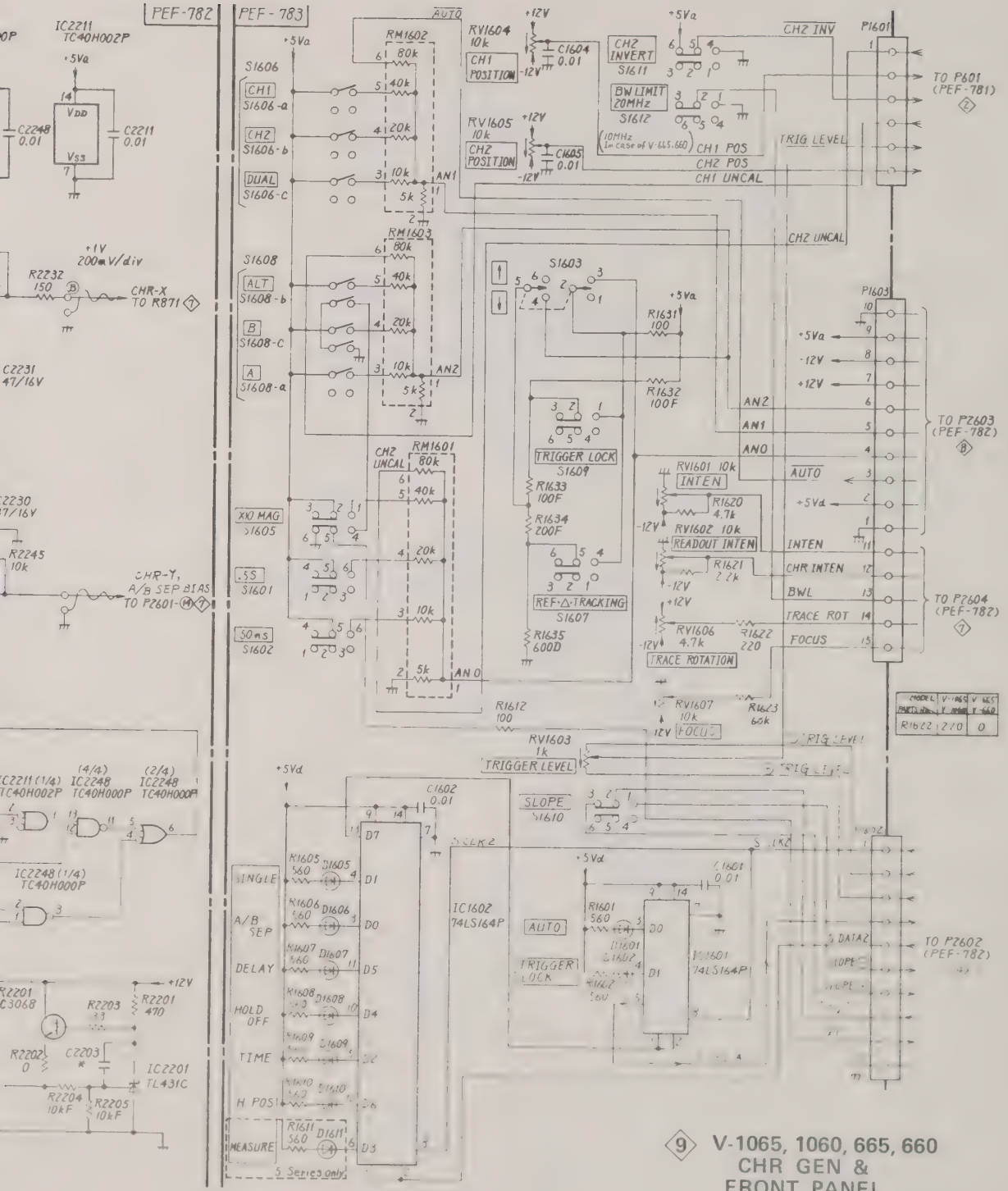
⟨7⟩ V-1065, 1060, 665, 660 H AMP & H OUT Z-CONTROL PEF-782, 784


+12V
+5Vd
-12V
-5V
IC2150 TL064CN
IC2130 HDA0051BP
IC2107 74LS00
IC2161 TC40H151P
IC2166 TC40H164P
IC2171 74LS393
RM2120 R=50k
A/B SEP BIAS TO IC2220-17
CUR FAS TO R2228-7
DLY CURRENT CYCLE↑ TO P2004-2
VAR H/O TO P2004-3
DLY PRESET TO P2004-1
CS A DATA TO R736-6
CS B DATA TO R737-6
H FAS TO R606-7
FROM IC2212-4 CUR-END
TO IC2248-2 CUR-SEL.
FROM P2003-5 H/O END
FROM IC2165-7 LATCH CHECK
TO IC2165-14
D1105-1
TO IC2107-7
TO P2602-1
TO IC2165-11 S-CLK2
TO IC2162-2
TO IC2140-3, TO R1105
TO IC 660-4 TEST SIG
DLY REF TO P2003-5
H/O ENB FROM P2003-1
FROM P2178
FROM R2177
H/O END FROM P2003-7
FROM DA48-4 DLY ADJUST
SWP GATE FROM R701-5
FROM P2602-4
TO R814, IC1012-7 X-Y
TO P2003-4 ROM1
TO P2003-3 ROM2
TO P2003-2 CL
TO P3104-
P3102
P3103
P3104
REF-70

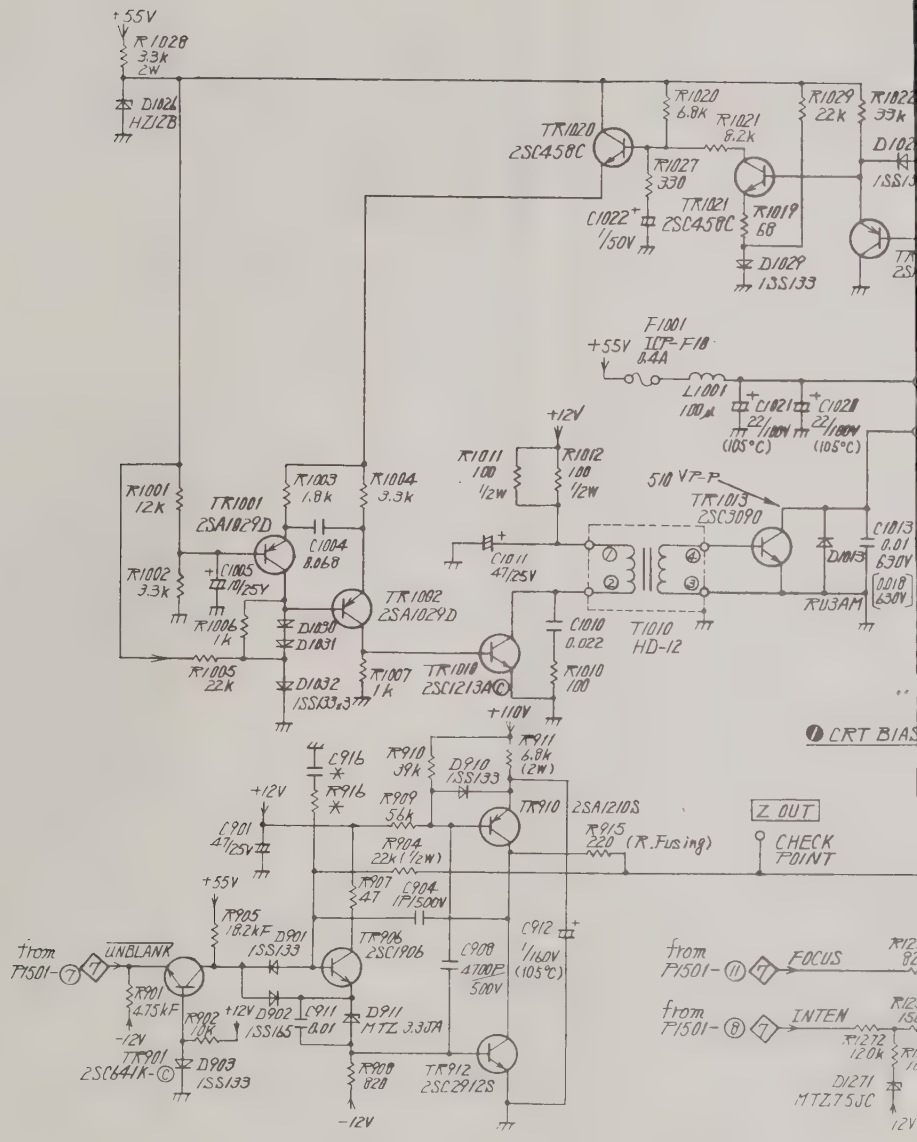


◈8 V-1065, 1060, 665, 660
μ-COM & ROM PG
PEF-782, 817

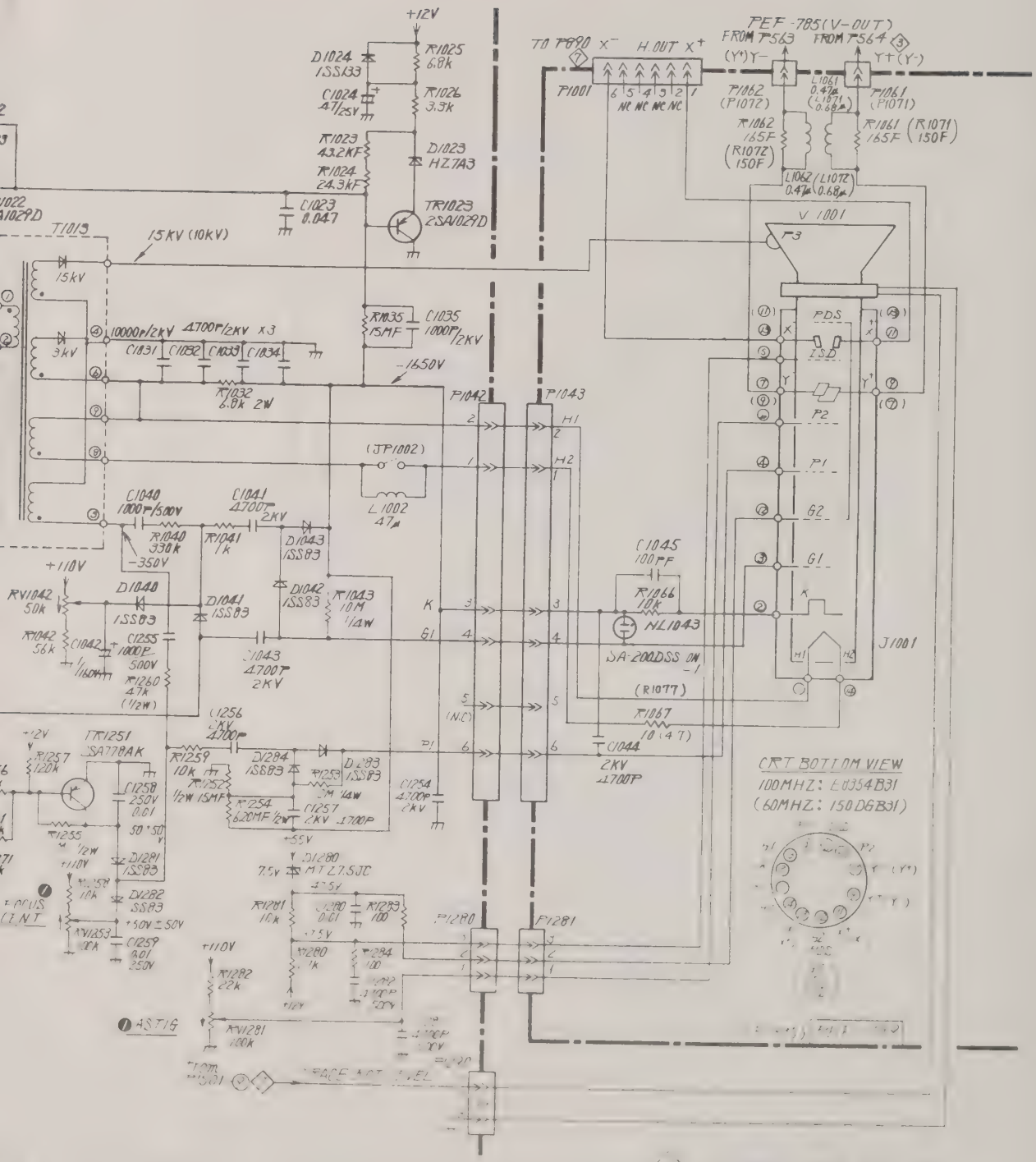

RM2232
R=50k
FROM P3105-
FROM P3106-
FROM P3107-
PF0
PF1
PF2
R2229 22.1KF
R2226A 1.65kF
R2226 2.43kF
CUR-POS FROM IC2150-
+5Va
-12V
R2220 100
R2221 1k
C2221 0.01
C2220 0.01
R2222 680
IC2230 NJM072S
IC2230A NJM072S
R2210 820k
R2236A 2.2k
R2235A 560
R2231 10
IC2220 MC74HC4052N
B A 出力
0 0 Y0 X0
0 1 Y1 X1
1 0 Y2 X2
1 1 Y3 X3
RM2231
R=50k
FROM P3107-
FROM P3108-
PF4
PF5
PF6
PD0
PD1
PD2
PD3
PD4
CHR PATTERN
R2225 562F
R2225A 137kF
R2246 4kD
R2247 1kD
C2247 47/16V
C2249 0.1μ
R2230 10
R2243 2.2k
R2249 100
R2211A 75.0kF
A/B SEP BIAS FROM IC2150-
CUR-EN TO R1109
C2215 1000P(CH)
R2212 18k
R2213 22k
D2212 1SS133
IC2248(3/4) TC40H000P
IC2211(4/4) TC40H002P
IC2211(3/4) TC40H002P
IC2211 TC40H002P
IC2212 HD14040B
C2212 0.01
C2210 1000P
RM2211
R=50k
DOT-EN FROM R1122
CUR-SEL FROM P3101-
FROM IC2165-
CURSOR PATTERN
C2202 47/16V
C2201 100/25V
FROM P3108-
CUR RESET
TO P3101-
CUR END



◈9◈ V-1065, 1060, 665, 660
CHR GEN &
FRONT PANEL
PEF-782, 783

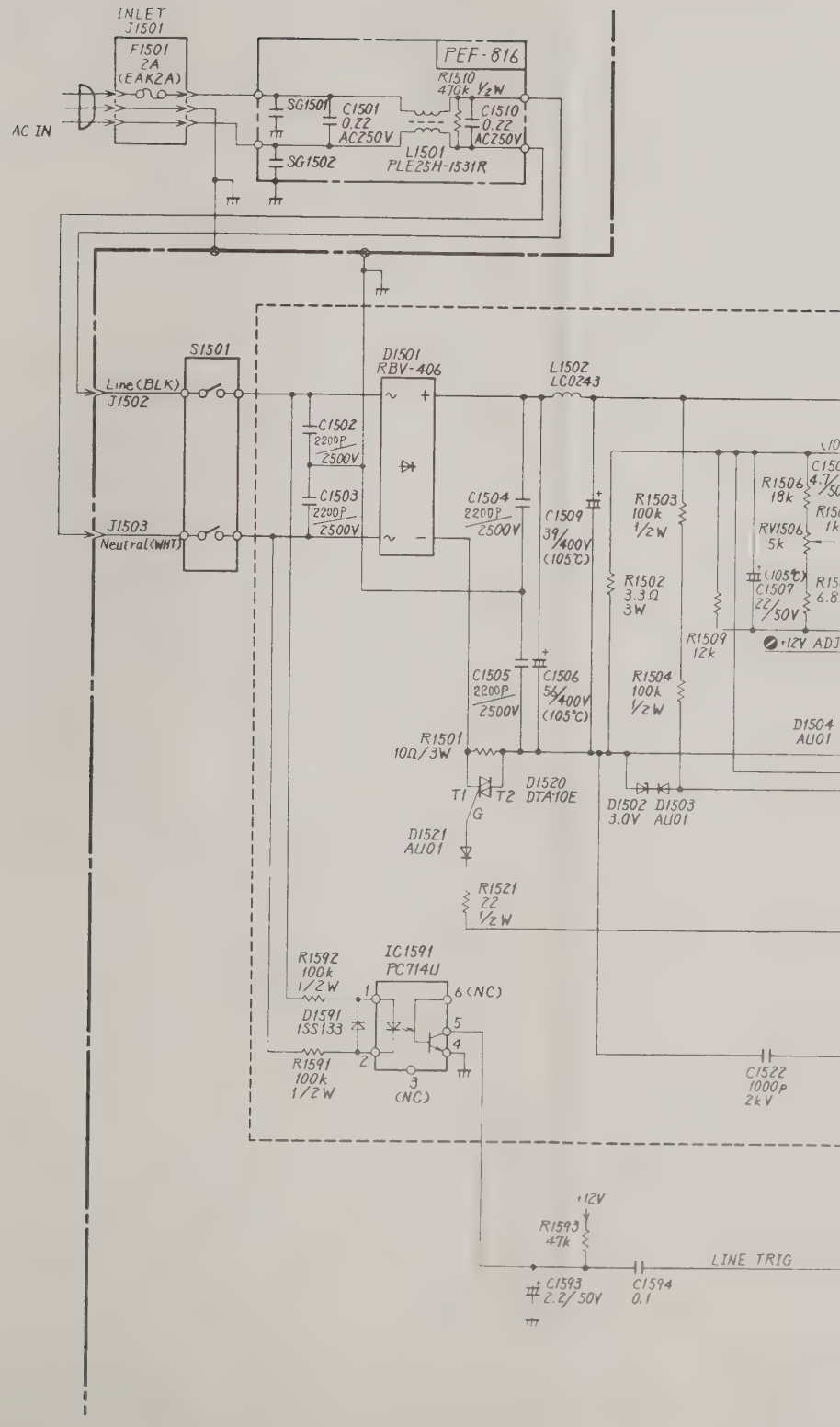

+55V
R1028 3.3k 2W
D1024 HZ12B
TR1020 2SC458C
R1020 6.8k
R1021 6.2k
R1029 22k
R1027 330
C1022 1/50V
TR1021 2SC458C
R1019 68
D1029 1SS133
F1001 ICP-F18 8.4A
L1001 100μ
C1021 22/100V (105°C)
C1028 22/100V (105°C)
+12V
R1011 100 1/2W
R1012 100 1/2W
5/10 Vp-p
TR1013 2SC3090
C1013 0.01 630V
D1013
0.018 630V
R113AM
R1001 12k
TR1001 2SA1029D
R1003 1.8k
R1004 3.3k
C1004 0.068
C1005 1/25V
R1002 3.3k
C1011 47/25V
TR1002 2SA1029D
R1006 1k
D1030
D1031
C1010 0.022
T1010 HD-12
R1005 22k
D1032 1SS133×3
R1007 1k
TR1018 2SC1213A
R1010 100
+110V
R911 6.8k (2W)
C916
R910 39k
D910 1SS133
R916
R909 56k
TR910 2SA1210S
Z OUT
CHECK POINT
+12V
C901 47/25V
R915 220 (R.Fusing)
R904 22k (1/2W)
+55V
R907 47
C904 1/P/500V
R905 18.2kF
C912 1/450V (105°C)
from P1501-7 UNBLANK
D901 1SS133
TR906 2SC1906
C908 4700P 500V
from P1501-11 FOCUS
from P1501-8 INTEN
R901 4.75kF
-12V
R902 10k
+12V
D902 1SS185
C911 0.01
D911 MTZ 3.3JA
R1272 120k
D1271 MTZ7.5JC
12V
TR901 2SC641K-C
D903 1SS133
R908 820
TR912 2SC2912S
-12V
CRT BIAS

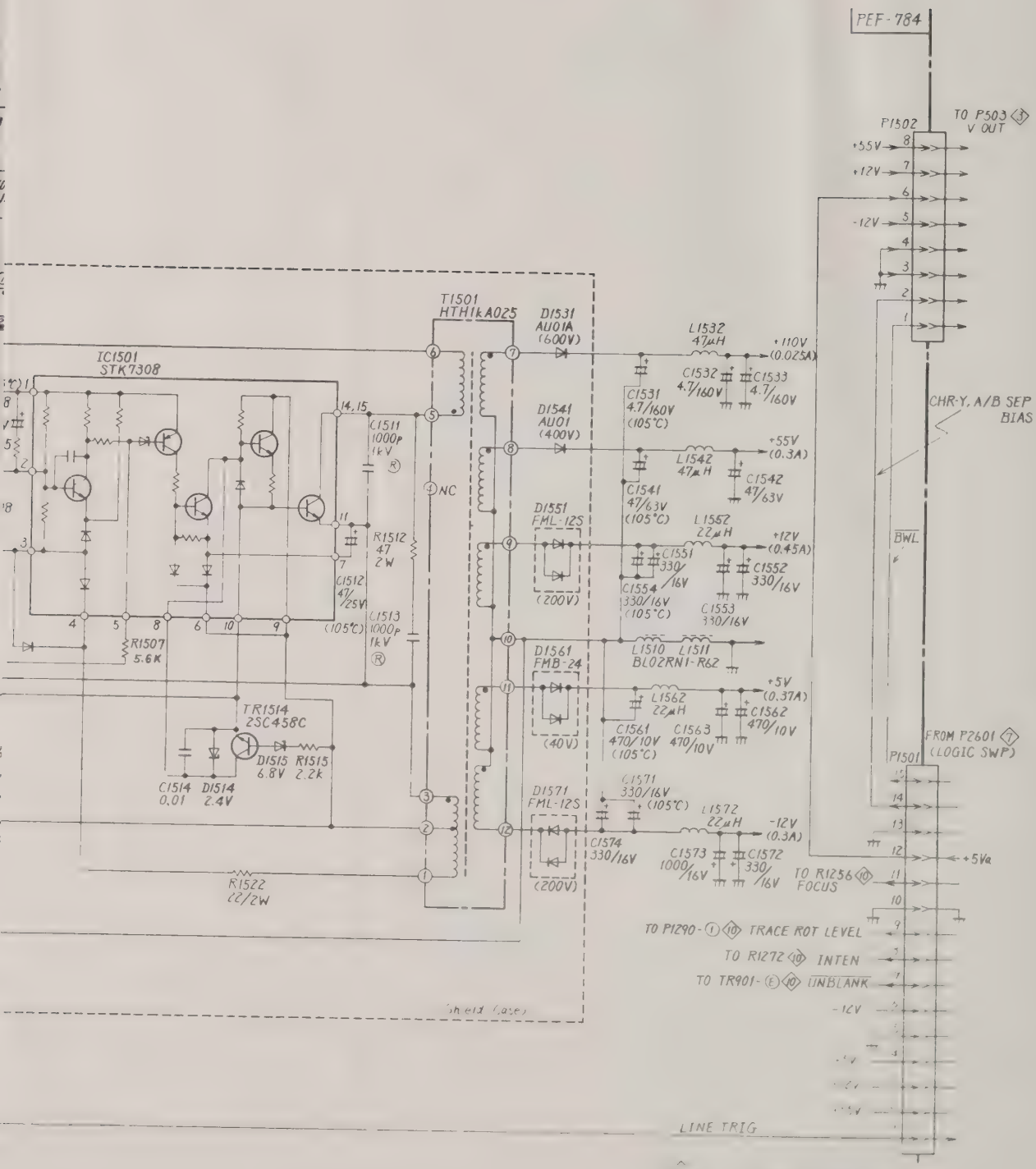
PEF 784



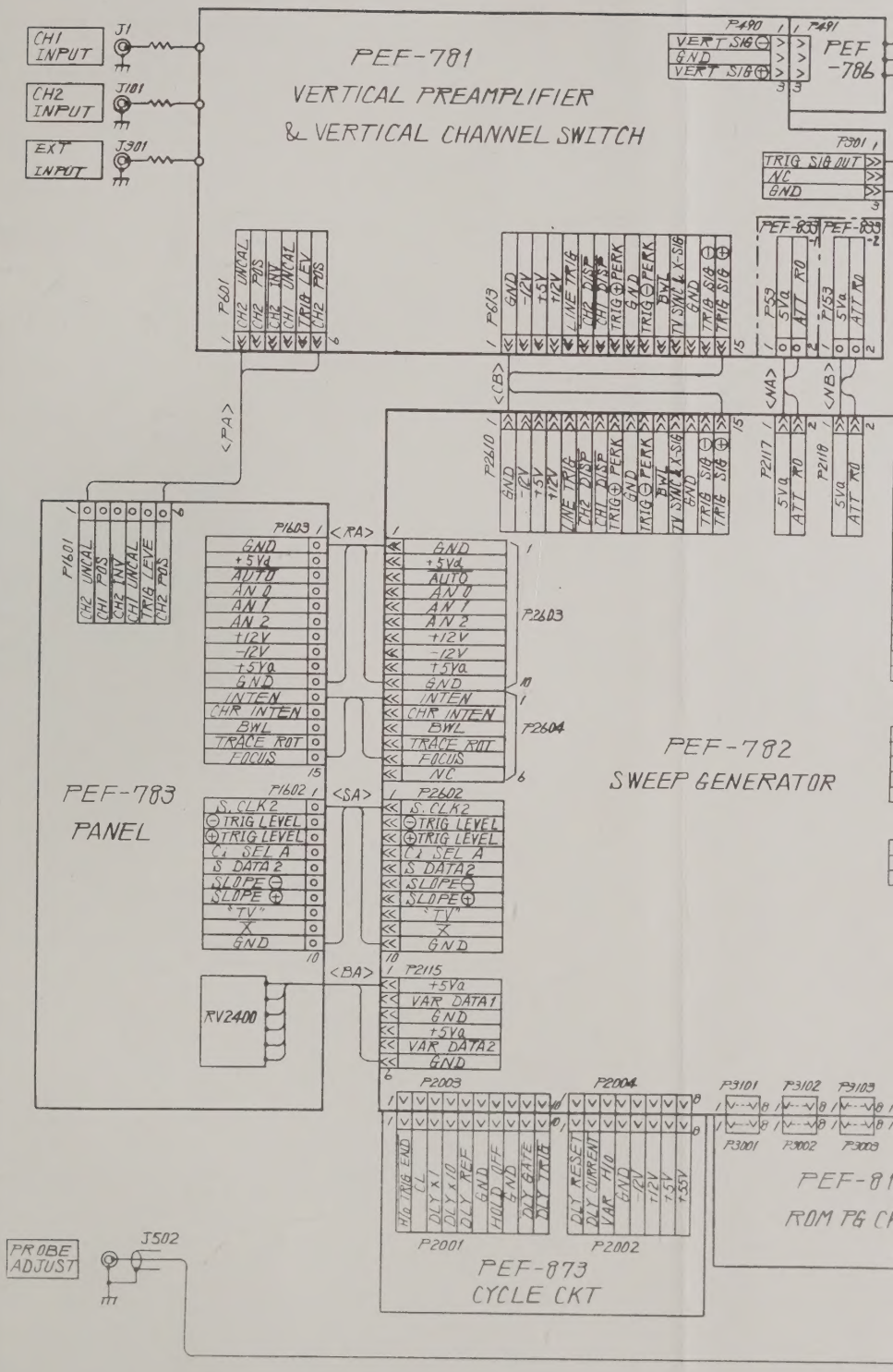
ase of V-665 and V-660

10 V-1065, 1060, 665, 660
HV, Z, CRT
PEF-784, 789


INLET
J1501
F1501
2A
(EAK2A)
AC IN
PEF-816
R1510
470k ½W
SG1501
C1501
0.22
AC250V
C1510
0.22
AC250V
L1501
PLE25H-1531R
SG1502
S1501
Line (BLK)
J1502
J1503
Neutral (WHT)
D1501
RBV-406
L1502
LC0243
C1502
2200P
2500V
C1503
2200P
2500V
C1504
2200P
2500V
C1509
39/400V
(105°C)
R1503
100k
1/2W
R1506
18k
RV1506
5k
C1507
22/50V
(105°C)
R1502
3.3Ω
3W
R1509
12k
+12V ADJ
C1505
2200P
2500V
C1506
56/400V
(105°C)
R1504
100k
1/2W
D1504
AU01
R1501
10Ω/3W
T1
T2
G
D1520
DTA10E
D1502
3.0V
D1503
AU01
D1521
AU01
R1521
22
1/2W
R1592
100k
1/2W
IC1591
PC714U
1
6 (NC)
D1591
1SS133
5
4
R1591
100k
1/2W
2
3
(NC)
C1522
1000P
2kV
+12V
R1593
47k
LINE TRIG
C1593
2.2/50V
C1594
0.1



11 **V-1065, 1060, 665, 660**
POWER
PEF-816, 784


CH1 INPUT
J1
CH2 INPUT
J101
EXT INPUT
J301
PEF-781
VERTICAL PREAMPLIFIER
& VERTICAL CHANNEL SWITCH
P490
VERT SIG
GND
VERT SIG
P491
PEF -786
P301
TRIG SIG OUT
NC
GND
PEF-853
PEF-853-2
P601
CH2 UNCAL
CH2 POS
CH2 INV
CH1 UNCAL
TRIG LEV
CH2 POS
P603
GND
-12V
+5V
+12V
LINE TRIG
CH2 DISP
CH1 DISP
TRIG ⊕ PEAK
GND
TRIG ⊖ PEAK
BWL
TV SYNC
X-SIG
GND
TRIG SIG
TRIG SIG
P53
5Va
ATT RO
<CB>
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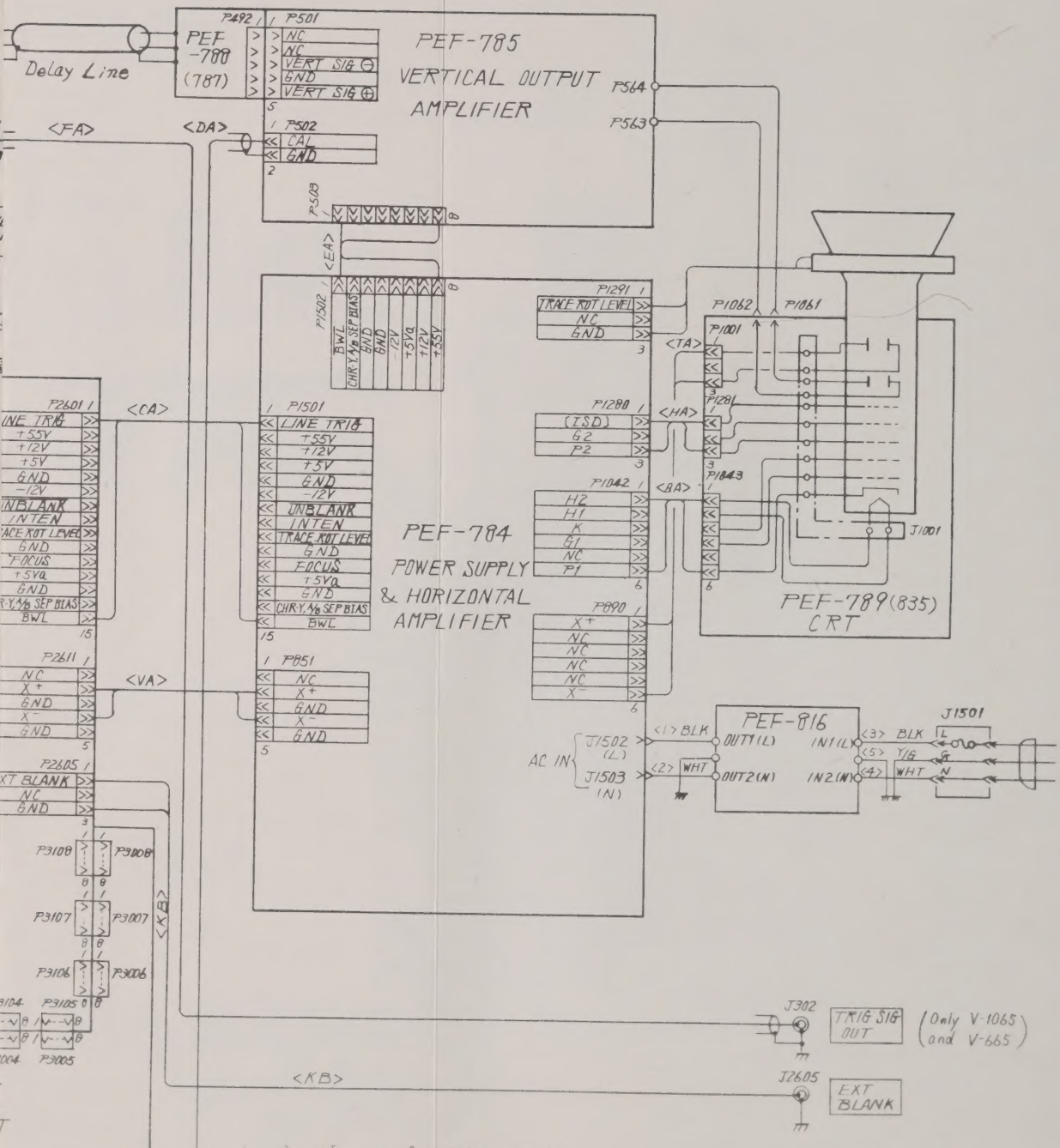
P2610
P2117
P2118
P1601
P1603
<RA>
P2603
P2604
PEF-782
SWEEP GENERATOR
PEF-783
PANEL
P1602
<SA>
P2602
S CLK2
TRIG LEVEL
TRIG LEVEL
C1 SEL A
S DATA 2
SLOPE
SLOPE
"TV"
X
GND
INTEN
CHR INTEN
BWL
TRACE ROT
FOCUS
NC
<BA>
P2115
+5Va
VAR DATA1
GND
+5Va
VAR DATA2
GND
RV2400
P2003
P2004
P3101
P3102
P3103
P3001
P3002
P3003
PEF-81
ROM PG CK
P2001
P2002
PEF-873
CYCLE CKT
PROBE ADJUST
J502



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